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'Knowledge is proud that he has learned so much,
Wisdom is humble that he knows no more.'—COWPER.

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School Surgery.

BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),
Vice-President of the British Medical Association.

VII.

DISEASES OF THE SKIN.

THE *Squamous, or Scaly Diseases.* This class is made up of two or three very distinctive forms, which in their typical state are easily recognisable. They are not inconsistent with apparent good health. Children are frequently sent to school suffering under one of the forms belonging to this class, viz., Psoriasis; it is perfectly free from danger of infection. It affords a curious comment upon names, for we find that originally it was applied to the Eastern disease 'Leprosy,' and was synonymous with the term venomous, or malignant. It is now appropriated to a condition of skin which is only an increased secretion of scales. This arises from an inflammatory state of cutis; there is exudation nto, and thickening of, that structure. These actions are local, and are not attended with any evident constitutional disturbance. The surface of the skin is dry, there are neither vesicles, pustules, or any ulceration. The affection may exist in the form of simple spots, when it is called 'Psoriasis punctata,' each restricted to a single hair follicle. Sometimes these spots slowly increase in size, and each occupies an area the sixth to the third of an inch in diameter, when it is styled 'Psoriasis guttata.' These patches are sometimes almost white, and are frequently called Lepra, or the disease may occupy larger patches of skin from the first, it is then called 'Psoriasis circumscripta,' or 'diffusa.' Patches may become inflamed, and give rise to an exzematous rash, and it is even difficult for the expert to determine at first sight whether the disease belongs to the scaly or the vesicular class. As it subsides the scales fall off, and leave roundish red spots, which may be dull or copper coloured; at length they die away, and the skin is left without any mark or discolouration, to show the former position of the eruption. This may be somewhat changed by the excessive scratching to which the spots may be subjected by the patient.

Sometimes the disease affects the nails, they become brittle and split, or it is limited to the palms of the hands, and soles of the feet. These cases are probably connected with an hereditary blood depreciation, consequent upon Syphilis in a former generation. Sometimes the disease is excessively obstinate, the skin cracks and serous discharges ooze from it. It is then called 'Psoriasis inveterata.'

If children can be kept clean, there is nothing in these cases to prevent them from mixing with their fellows. It is a chronic disease, especially liable to relapse. It would be wrong to exclude the subjects of it from going to school on account of its nature. Probably half the cases which actually arise do occur in children. It is not uncommon, and it is well that managers should be able to recognise it, and act accordingly. Occupation, and regular habits by promoting good health, may help to cure it; whilst foul air, bad habits, and improper food, will tend to make it 'inveterate;' excess in eating and drinking fatigue or excitement of any unnatural kind, will render it more intractable. It requires medical treatment for its cure, which will be generally found in the internal administration of minute doses of arsenic or iodide of iron, and the local application of some of the creosote, or tar preparations which are now frequently to be met with. The diet should be simple: Salt meats, pork, spices, and stimulants should be altogether prohibited. Coffee, by drying the skin, is also injurious. Fresh fruits, vegetables, and milk foods, are more advantageous than meat. If there is a syphilitic taint, it will continue to teaze the constitution until some other and more serious malady takes its place.

Pityriasis is another scaly disease. The name is derived from a Greek word signifying bran, and a branny kind of scale is its distinctive feature. It is requisite to avoid mistake, and not to confound it with the desquamation, which arises after measles or scarlatina. It would be difficult for the non-medical mind to distinguish the one from the other, if it were not for the general illness which had preceded the one, but not the other. It is sometimes mistaken, and much unnecessary alarm excited when the skin disease is thought to be the sign of the eruptive complaint. Another mistake is often made regarding the form which is known as 'Dandriff,' 'Pityriasis capitis.' This is due to an excessive secretion from the sebaceous glands in the scalp, and may be mistaken for infectious disease, whilst it is really harmless; but it is indicative

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of a want of cleanliness, and the collection of scales in the hair may be a nidus for infectious disease, if such children come in contact with the germ which produces ringworm or favus. A form of chronic erythema is sometimes called Pityriasis improperly; it is seen at the corners of the mouth, on the lips and cheeks of delicate children. It may be induced by the use of soaps which are too alkaline, or by any means which will take off the epidermis in too rapid a manner, by which the tender cuticle is too much exposed. 'Pityriasis simplex' occurs in the form of small white round patches in the hairy parts of the body, which become covered with branny scales, and may give rise to patches of baldness. The baldness will not arise if the patch is cured quickly. This may be rapidly effected by using a solution of borax in rose water (one dram of salt to the ounce), and afterwards applying a solution of bichloride of mercury, such as was prescribed for the cure of Acne.

Frequent bathing in soft water, and an unction with pure salad oil, will help to get rid of the tendency.

There is a form of disease called 'Pityriasis versicolor,' which is due to a parasite, and which can only be cured by destroying the fungus which produces it.

Ichthyosis, or the *Fish skin disease*, need only be mentioned. It is sometimes seen in a very slight form, in which the skin is mapped out in a quadrangular or irregular-shaped segments, covered with slabs of cuticle, adherent in the centre but loose at the sides. Sometimes the whole body seems covered with laminæ of cuticle loosely adherent to the cutis; it is smooth and shining. It is not of such a character as need excite the attention of the master, except to see to the scrupulous cleanliness of the child, and that the diet be always wholesome.

The *Vesicles* consists of several forms of malady under the names (1) Sudamina, (2) Miliaria, (3) Eczema, (4) Herpes or Tetter, and a class which go by the name of (5) Blebs, or Pemphigus and Rupia.

Varicella and Vaccina are sometimes called Vesicular, but it is more convenient to class them with the Exanthemata.

'Sudamina' are simple transparent vesicles, which are often met with upon the bodies of rickety or tubercular children, who sweat much. They are hemispherical and smooth. They are not uncommon in the course of continued and other fevers. Miliaria are similar; they are not hemispherical, but acuminated and surrounded by a zone of redness. They are met with in cases of fever, and only call for mention.

Eczema is one of the commonest of skin diseases. It arises in the form of minute vesicles, containing serum. The fluid evaporates or absorbs, and their flakes or crusts are left. There is an erythematous condition, with heat and tingling. The skin is red and raw looking. As soon as the flakes are removed, or even before the removal, there is a fresh crop of vesicles. The parts burn, or tingle and itch most abominably. It is closely allied to the papular and scaly forms of disease, and, when inveterate, renders life a positive burthen to the sufferer. It may be set up by the use of irritant applications in constitutions prone to it. It often accompanies scabies, that is the disease which the itch insect produces. I have often seen it rendered extremely difficult to cure by the action of the little microscopic red insect called the harvest bug, which frequents the thickets and hedgerows on the chalk hills of Surrey. It burrows into the legs and arms of boys who hunt them for birds' eggs and blackberries, and if the cause is not recognised cure will not follow upon the treatment adopted. The distinctive characteristic of Eczema is the fibrinous exudation which stiffens and stains the linen garments of the wearer. The discharge, which comes from a simple chafe caused by friction ('Erythema intertrigo' is its scientific name), is not abundant, and does not stiffen the linen, so need not be mistaken for that disease. Eczema is common in children, and when it affects the head is called 'Eczema capitis.' The discharge is yellow, from mixture with sebaceous secretion. There is excessive production of epidermis; the fluid becomes purulent, and the hair mats together, forming a disgusting mass. This form differs from the infectious form called 'Tinea Tonsurans,' or Favus, inasmuch as that the hairs are intact, not broken off, twisted, and sheathed with a fine white deposit, as is the case in favus. There is also no moist discharge. The disease sometimes affects the ears, especially the grove behind the pinna. It sometimes affects the hands in those who handle sugar, soda, dyes, and other irrirating merchandise. 'Grocers' itch,' 'washerwoman's itch,' and 'bakers' itch' are all varieties of Eczema.

The treatment of this form of complaint is mixed up with constitutional remedies, and cannot be got rid of by local measures. Diet should be moderate, stimulants altogether avoided, and the immediate exciting cause be removed. The tendencies of the child must be considered as to whether there is any syphilitic, rheumatic, gouty, or scrofulous tendency, or whether it has had its origin in outside causes. The local crust should be removed by bread-and-water poultices, the hair must be cut to expedite the removal of the crusts, and the part affected kept scrupulously clean. A more decided course of treatment must be prescribed by the medical attendant, which will be according to the tendencies above referred to, for each requires a different class of medicine.

Herpes or *Tetter*, as it is commonly called, is a non-contagious and vesicular disease taking on several forms. The most common is 'Herpes liabialis,' a breaking out in the lips, which indicates cold, and may disappear after a few days; or it may be the accompaniment of a much more serious complaint, and is often one of the signs of inflammation of the lungs. It begins by redness and heat in a small patch. The vesicles scab over in two or three days, and if left alone fall off without leaving any permanent scar. When they form in the throat they give rise to considerable constitutional disturbance.

'HERPES ZOSTER,' or shingles, is another form of the disease. This form is limited to one side of the body. It is occasionally preceded by very great pain, and has been mistaken for Pleurisy, as its usual seat is on the ribs, although it may appear on any part of the body. The crop of vesicles is connected with some nerve disturbance, the nature of which is not yet fully understood. It commences with a hard inflamed base; the vesicle contains clear fluid at first. This changes in a few days to opaque lymph, which dries up and leaves a black scab. It is attended with a burning, pricking heat, and itches a great deal as it dies away. Old people often have a deal of neuralgic pain in the seat of the eruption, which may continue after all sign of the eruption has ceased, but this is quite unusual in children. Local treatment is best let alone. The vesicles should be covered up with

cotton wadding, so as to avoid friction, and not interfered with; whilst if the appetite is indifferent and the tongue foul, a little senna tea, followed by a dose or two of Gregory's powder, will be all the treatment that will be required. If the scabs are inclined to cause any breach of surface, they may be dressed with zinc ointment night and morning until they are entirely separated, and the surface of the skin has healed. 'Herpes cicinatus,' or Iris, is a form improperly named Herpes, and in which the disease is caused by a parasite. It is infectious.

The *Bullæ* or *Blebs* are serious forms of disease, which are not likely to be met with in children at school. They are connected with a blood disease, and always require skilful medical treatment to effect a cure. In Pemphigus there are large blebs filled with an albuminous alkaline fluid, with an ulcerated under surface. In Rupia the bleb dries up and forms a crust, which becomes thicker as it rises above the level of the skin, and when it drops off leaves a deep ulcer in the skin, which heals after a time, leaving a distinct and specific mark behind it.

The *Pustules.* The last class to be considered are the Pustules, excluding Farcy and Small Pox. They are limited to two forms, 'Ecthyma' and 'Impetigo.' They are not common diseases. The former are round isolated pustules, with hard inflamed bases, which form brown adherent scabs, and when they drop off they leave a violet stain in the skin, but this fades away in time. Tartar Emetic ointment is sometimes used to bring out an eruption of this kind for purposes of counter irritation. The disease may be either acute or chronic. The latter assimilates very much to a crop of boils, but runs a slower course, is more painful, and has a core which does not form in a case of Ecthyma.

'*Impetigo*' is more common; it may be caused by local irritation, such as Pediculi in the heads of children, or by improper food or a poor kind of diet. The pustules occur in groups, which come to maturity in forty-eight hours, and rapidly discharge a thick purulent matter, giving rise to a brownish-yellow irregular-shaped crust. These crusts are slow in separating, and are sometimes mistaken for a more infectious form. The character of the pustule in Impetigo Capitis should at once distinguish it from Tinea or Favus. When it attacks the face of children it is called 'Crusta lactea.' Impetigo is sometimes contagious, and seems to spread from child to child, so that care is required to distinguish it. It seems as if the secretion in the heads of some children render them excessively prone to grow crops of pediculi. The ova of these parasites, popularly known as 'nits,' will be seen attached to the hair. They may be detached by washing the hair with vinegar and water, and then dressing the roots with white precipitate ointment or decoction of staves acre. This latter is the basis of the Persian insect powder, which is used for the same purpose. The presence of nits either favours the production of Impetigo, or the latter encourages the breed of the former, as they are very often in company. Cleanliness and the use of sulphur ointment occasionally if the presence of the nit is suspected will be the best plan to adopt.

From preceding observations it will be understood that diseases of the skin arise from several causes: they may be constitutional and inherited; they may arise from infection or local irritation. Each cause requires a different kind of treatment, but all require the most scrupulous cleanliness and attention to diet. It is requisite to distinguish the constitutional tendency, because it is of more consequence than the name of the skin disease. First determine the point as to its contagious or non-contagious character, then the constitutional tendency, and thirdly, attend to the diet of the child. This should be vegetable, fruits, fish, and milk foods, whilst stimulants, meats, and indigestible things should be studiously avoided.

(To be continued.)

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Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,

Author of 'Homes without Hands,' 'Nature's Teachings,' etc.

AND THEODORE WOOD, M.E.S.,

Joint Author of 'The Field Naturalist's Handbook.'

No. XIX.—THE BEAR TRIBE.

Part II.

THE animals belonging to the curious group of Sun-bears derive their name from their habit of basking in the rays of the hottest sunshine, instead of retiring to their dens during the heat of the day, after the manner of bears in general. The generic title of *Helarctos* refers to this habit, being a compound of two Greek words, the one signifying the sun and the other a bear.

As a representative of the genus, several species of which are known to exist, we will take the Malayan Sun-bear, or Bruang (*Helarctos Malayanus*), a native, as its name implies, of certain parts of the Malay Archipelago.

This is by no means a large animal, seldom measuring more than four feet six inches in length when fully adult. The muscular powers, however, are very great, far more so than might be imagined when the small size of the bear is taken into consideration.

The lip and tongue are very flexible, and the latter organ is capable of considerable elongation. It is thought that this structure is intended to assist the animal in robbing the nests of the wild bee, by inserting its long and lithe tongue into the apertures, and licking out the contained treasures.

The colour of the fur is a deep, glossy black, with the exception of a crescent-shaped white mark upon the breast and a yellowish-white patch upon the snout and upper jaw. The hair is rather short, but is of a very fine and delicate quality, which renders the skin of some little value as an article of commerce.

The bruang seems to be almost exclusively a vegetable feeder, giving the preference to fruit of various kinds, and more especially to the young shoots of the cocoa-nut palm. So fond is the animal of this latter diet that in some parts of Sumatra, where the villages have been deserted hy their human inhabitants, the cocoa-nut plantations have been completely destroyed by his constant degradations.

Being a singularly even-tempered animal, the bruang is easily tamed, and speedily adapts himself to the conditions of his new mode of life. One of these bears, which was in the possession of Sir Stamford Raffles, was of so quiet and peaceable a disposition that he was

even allowed to remain unchained in the nursery tenanted by his master's children, and was also allowed to sit at table together with the family.

Here he became so fastidious in his diet that he would refuse any fruit except mangosteens, and any wine except champagne, for which beverage he developed a great fondness. His master used to say that he never knew his pet to lose his temper except when his favourite liquid was withheld.

Included in the same group of the ursine family, although not belonging to the same genus as the bruang, the Aswail, or Sloth Bear (*Melursus Lybius*), next claims our attention. This strange-looking creature is a native of the mountainous parts of India, where it is an object of great admiration, mingled with considerable dread, to the native population. It is by no means a fierce animal, however, and even if attacked and slightly wounded will, as a rule, seek safety in flight rather than attempt to revenge itself upon its pursuer. But if driven to bay, or enraged by a severe wound, it becomes a very dangerous enemy, and will fight with furious energy until it either destroys its foe, or is itself slain.

The peculiar aspect of the aswail is chiefly owing to the length of the hair, which falls in thick clusters over almost the entire body. The colour is a jetty black, with the exception of a forked patch of whitish hairs upon the breast.

The aswail is not in the habit of basking in the sunshine, like the animal about which we have just been reading, but retires to its den during the greater part of the day. This habit is probably owing to the structure of the feet, the soles of which are remarkably tender. So much is this the case, indeed, that in several instances, when the bear has been driven from its hiding-place, and pursued by hunters during the heat of the day, the soles of the feet have been found to be terribly scorched and blistered with the heated stones and rocks over which the animal has passed.

Owing partly to the nocturnal habits of the aswail, and partly to the dread with which it is regarded by the natives of the country it inhabits, we know comparatively little of its mode of life when in a state of freedom. It seems to exist upon an almost purely vegetable diet, varied only, except upon very rare occasions, by such small creatures as slugs, ants, bees and their honey, and so on.

THE last of the true bears which can be described in these pages is the well-known Polar Bear (*Thalarctos maritimus*), the Nennook of the Esquimaux.

All the bears are good swimmers, and are able to cross rivers, etc., with perfect ease, should occasion arise for so doing. The nennook, however, far surpasses its congeners in the matter of aquatic locomotion, being able to pursue and capture the very fish themselves in their native element, and almost to rival the seals in the ease and agility of their movements.

Being intended by nature to lead in great measure an aquatic existence, we may expect to find that in the polar bear some points of structure are modified to suit the requirements of its mode of life. And such is indeed the case, for the form of the body is such as to enable the animal to cleave through the water without any great exertion, while the huge and hair-clad paws afford excellent paddles for the supply of the necessary propelling power. Then, the senses, more especially that of scent, are exceptionally keen, as is proved by the fact that the animal will discover, by the exercise of its olfactory powers alone, the tiny breathing-holes which the seals have made through the ice, even though those breathing-holes are covered with a thick layer of snow.

In the capture of its prey, which chiefly consists of seals and fish, the polar bear is remarkably adroit, having been repeatedly seen to dive into the water after a salmon, and re-appear almost immediately with the captured fish in its mouth. With regard to the seals, however, which are fully its equals in the natatory art, and possess, moreover, the power of remaining below the surface of the water for a considerable period of time, the bear adopts very different tactics.

Let us suppose that it has caught sight of a seal resting near the edge of a floating piece of ice at some little distance. Plunging noiselessly into the water, the bear at once dives, and proceeds as far as possible in the required direction before seeking a fresh supply of air. When this becomes necessary, the animal merely pokes its nostrils above the water for a few seconds, without exposing to view any other part of its body. As soon as the act of respiration is completed, it again dives, and so on until it has passed over the distance which separated it from the object of its attack. The last dive is always timed so that the bear makes its appearance within a few feet of its anticipated victim, which has now no chance of escape. If it attempts to take to the water it is immediately seized by its expectant enemy, while if it should take to flight across the ice it is quickly overtaken by the more active bear.

The nennook owes its peculiar activity upon the frozen surface to the thick hair with which the soles of the feet are covered, and which enable it to pass along almost as readily as upon dry land. It also serves a second and equally important purpose, protecting the foot from the extreme cold of the substance with which it is so constantly in contact.

The size of the paws is wonderfully large, their length being fully one-sixth of the entire length of the body. The claws with which they are armed are not as long as in some of the preceding animals of the group, and are but slightly curved. Nevertheless, they form very terrible weapons, by the aid of which the bear can slay the huge walrus itself, beating in its skull by repeated blows of its mighty paw, as was mentioned in a prior article of this series.

The head is rather small when compared with the size of the body, and this circumstance, together with the length of the neck, gives a very snake-like appearance to the fore-parts of the animal's person. The fur is of a silvery-white hue, tinged with cream-colour, which varies in intensity in different individuals. The claws are black, forming a great contrast to the whiteness of the fur.

For many years great uncertainty prevailed as to whether the polar bear passed the winter months, or any part of them, in a state of hibernation, some observers telling us that the animal invariably retired to some sheltered retreat during the winter, while others asserted that nennooks might be seen at large throughout the whole of the year. Neither of these reports was altogether correct, nor yet entirely wrong, for it has lately been ascertained that the female bear alone hibernates, while the male continues to roam about in search of prey just as at any other season.

Neither does the female hibernate unless she is

about to become a mother, in which case she selects some sheltered spot for her habitation, generally choosing the cleft of a rock, or some such situation, where she may be, at all events, partially protected from the inclemencies of the weather. Before she has been a tenant of her new home for very long she is completely covered by the snow-drifts, being thus effectually screened from the observation of enemies.

The young of the polar bear are generally two in number, and are born about two months before their mother makes her reappearance in the world. By the time that this event takes place they attain to a considerable size, being then about as large as an ordinary shepherd's dog.

Although to a great extent aquatic in its habits, the polar bear is often found at a considerable distance from the sea-coast, specimens having sometimes been met with more than thirty miles inland. These excursions are generally brought about by hunger, either from the failure of the food-supply, or, as frequently happens, from the fact that the bear has been carried to a considerable distance from its usual haunts by the separation from the main body of the piece of ice upon which it is resting. Sometimes quite a small colony of bears are carried off in this manner, causing terrible havoc amongst the herds of the country in which they may happen to land.

Besides being endowed with great strength, the nennook is also possessed of considerable powers of endurance, as may be imagined from the fact that upon one occasion one of these bears was seen steadily swimming across a channel more than forty miles in width. Indeed, as far as the natatory art is concerned, it is but little inferior to the seal, and its proficiency in this respect, together with its great muscular power, and the terrible weapons with which it is provided by nature, renders it the acknowledged monarch of the polar seas.

Even the enormous and powerful walrus falls a victim to the polar bear, and the strength of the bear can be best appreciated by comparing it with the animal which it kills. A fine male walrus measures some fifteen feet in length, so that if it had legs fit for walking, it would surpass in size the generality of elephants.

In order to understand the real size of the walrus, let the reader measure a line of fifteen feet in length upon the wall of a room, then let him sketch in imagination the form of the animal as shown in any illustration, and he will see what an enormous creature it is. We will here briefly recapitulate the method by which the bear can destroy a prey so much larger and stronger than itself.

Like the rest of the seal tribe, the walrus is in the habit of leaving the water and sleeping on shore or on the ice. When the polar bear attacks a walrus, it always chooses the one that is farthest from the sea. Creeping silently behind the sleeping animal, the bear leaps on its back, holds on with its hind feet and one of the fore-paws, while with the other it delivers a series of rapid blows on the head.

The startled animal at once makes for the sea, but unless it be an old one, it generally succumbs before reaching the water, the skull being battered in as if with blows of a sledge-hammer. In the old walrus, however, the skull is so thick and strong that it can resist even the white bear's paw. The bear bangs away as long as they are ashore, but if the walrus can once reach the water, it is safe. The water prevents the bear from delivering its terrible blows, and as the bear knows instinctively that the walrus can remain under water for a very long time, it relinquishes its prey.

Many an old walrus is killed which has its head, neck, and shoulders all seamed and scarred by the talons of the bear.

The thick fur of this bear, like that of the seal and the feathers of the duck, repels the water, so that the skin remains perfectly dry. The fur, however, must be in good condition, or it loses this protective power.

Some years ago a young polar bear was forwarded to the Zoological Gardens. It naturally made for the water, and soon was noticed to be floundering about in a very awkward manner, until at last it sank. The water was at once drawn off, and the animal rescued. Then it was found that, during the long journey, the fur had become clogged with dust, so that the hairs could not 'set' properly, and admitted the water between them. Consequently, the poor creature was actually being drowned by the weight of its own fur.

WE must now bid farewell to the Bears, properly so called, and turn our attention to some of the other members of the ursine group.

The most familiar of these is the well-known Racoon, or Mapach (*Procyon Lotor*), which presents in its general appearance a well-marked resemblance to some of the preceding animals.

The gait of this animal is rather peculiar. A plantigrade, like all the members of the ursine group, it is so only when standing, sitting, or slowly moving, proceeding after the fashion of the digitigrades when hurried or otherwise excited.

The fur of the racoon is of two qualities, a coat of soft, warm hair lying next the skin, while a number of long bristle-like hairs form a kind of thatch to the whole. The markings of the body are of a rather complicated nature, and are by no means easy to describe with any degree of exactness.

The woolly fur lying next the skin is of an uniform grey colour, while the longer hairs which project through it are marked alternately with black and greyish-white. Upon the knee-joints, the top of the head, and across the eyes, the fur is very much darker than upon the rest of the body, approaching, indeed, very closely to black in its depth of hue. The tail is of a dark-grey colour, marked with several bands of brownish-black.

Like all the preceding animals of the group, the racoon subsists upon a diet consisting of both animal and vegetable substances, seeming, as a general rule, to prefer the latter. It is very partial, however, to crabs, oysters, and other animals of a similar character, contriving to secure and despatch the former without affording them an opportunity of retaliation. As regards the latter creatures, however, it is not always equally successful, and many stories are told of racoons which have been so firmly held by the oysters which they were endeavouring to open that they have been unable to release themselves from their painful bondage, and have accordingly perished by the advancing tide.

The racoon is a very thirsty animal, and, besides drinking great quantities of water, has a peculiar habit of moistening its food, wherever practicable, before proceeding to devour it. This it does by grasping the food in the fore-paws, and shaking it rapidly backwards and forwards in the water until it has absorbed a sufficient quantity of liquid. Owing to this curious practice, the animal has received the specific title of *lotor*, *i.e.*, 'a washer.'

The racoon is nocturnal in its habits, and, being a very active and agile animal, is held in great favour by the colonists as an object of pursuit. It is usually hunted by means of dogs, which chase it until it seeks safety in the branches of some tree. A fire is then lighted beneath its refuge, in order to afford sufficient light for one of the hunters to ascend the tree and dislodge the animal from its perch.

In spite of the comparatively small dimensions of their quality, a full-grown racoon only equalling a small fox in size, the dogs do not always meet with an easy task when despatching their victim. Once fairly driven to bay, the hunted animal flies at its pursuers with the greatest fury, and seldom succumbs without having severely wounded one at least of its foes.

RESEMBLING the racoons in many respects, the curious animals known as Coaitis may be at once known by the prolongation of the muzzle, which forms a mobile snout of great service to the animal when rooting in the ground in search of the worms, etc., which form a great proportion of its diet. When drinking, the snout is turned upwards, in order to keep it as much as possible out of the water.

All the coaitis are natives of South America, being generally found in small clusters amongst the branches of trees. One of them, the Coaiti-mondi, or Red Coaiti *Nasua rufa*), is so named from the colour of its fur, which is of a bright chestnut hue upon the greater part of the body, with the exception of the ears and legs, which are black, and the tail, which is marked with maroon-coloured bands. A patch of whitish hairs is found upon the jaws.

This animal is wonderfully active amongst the tree branches, galloping from bough to bough with an agility little, if at all, inferior to that of the squirrel itself. It invariably descends the trunks with its head towards the ground, trusting for its foothold chiefly to the claws of the hinder feet, which can be inserted into the smallest crevices of the bark. Like almost all the ursine animals, it is nocturnal in its habits, passing the hours of daylight in some sequestered nook where it is tolerably secure from the attacks of its foes.

Want of space precludes us from describing the other species of coaiti known to science, and we must therefore pass to the remarkable animal known as the Kinkajou, or Potto (*Cercoleptes candivolvulus*).

This is one of those anomalous creatures of which one at least is to be found in almost every family of animals, and considerable uncertainty still prevails as to whether it is rightly placed in its present position. In its general appearance, and in its habits, it bears a very strong resemblance to the lemurs, with which animals it was at one time ranked. The structure of the teeth, however, caused it to be separated from that group, and assigned a position amongst the *carnivora*, under the title of the Mexican Weasel. Again, however, the structure of the teeth was taken into consideration, the surface of those in the lower jaw being adapted for grinding vegetable substances, and the fact, together with the prehensile nature of the tail, caused it to be situated, at any rate for the present, at the end of the ursine group.

The kinkajou is an inhabitant of Southern America, where it is spread over a very large extent of country. Its existence is chiefly arboreal, its long claws and prehensile tail being of great assistance in its evolutions amongst the branches.

The tongue is endowed with singular flexibility, and can be lengthened to a wonderful extent. By its aid the animal is enabled to rob the nests of the wild bee, inserting the tongue into the orifices, and licking the honey from the waxen cells. Insects, small birds,

eggs, fruits, etc., constitute the remainder of its diet.

The kinkajou is not a very large animal, about equalling in size an ordinary cat. It is easily tamed, and is a very pretty, affectionate pet. Some years ago I made acquaintance with a kinkajou in the Zoological Gardens. The animal was always delighted to see me, and when the keeper opened the cage the kinkajou would clamber to my shoulder, and sit there quite happy, with its long, soft tail coiled round my neck.

(To be continued.)

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Eminent Practical Teachers.

DAVID STOW,

*Founder of the Training System of Education.**

BY JOHN R. LANGLER, B.A., F.R.G.S.,

Of the Westminster Training College, Ex-President of the National Union of Elementary Teachers.

THE personal history of an eminent philanthropist must ever prove interesting and attractive, especially if the incidents of his life have determined the character of any great scheme with which his name has become inseparably associated. It is, unfortunately, beyond our power fully to determine the effects of circumstances on the life-work of David Stow; but, though the desired details are not at our command, it may still be possible to explain to some extent, and in connection with a brief biography, the historical development of the Moral Training System of Education of which he is the distinguished author.

David Stow was born on 17th May, 1793, at Paisley, to which town his father, Mr. William Stow, had removed from Durham to engage in business as a merchant. His mother's maiden name was Agnes Smith, a Christian lady, remarkable for the 'devotedness with which she trained her children in the fear of the Lord.'

Alexander Wilson, the ornithologist, John Wilson, the author of the celebrated 'Noctes Ambrosianæ,' etc., James Wilson, the entomologist, Robert Tannahill, the poet, John Henning, the sculptor, and other men of note, were fellow-townsmen, and near contemporaries of David Stow; and in the early part of the present century Paisley had a renown for the pursuit of natural science, literature, and art, which it still retains, though the transformed town is no longer, as Rowland Hill described it, 'the Paradise of Scotland.'

Mr. William Stow for many years held the office of magistrate. His son David received at the Paisley Grammar School the ordinary English and classical education given to pupils of his rank, and it is said that in all his classes he gained 'an honourable place.' The character of the instruction given at that time was, however, little calculated to develope the intelligence. School work chiefly consisted in taxing the memory, in many cases most unprofitably, as the acquired words and phrases were never explained, and the principles embodied in oft-repeated rules were rarely illustrated or applied. 'The religious instruction was little more than the reading of the Bible, which teachers managed to make the most distasteful of text-books.' Any true pleasure obtainable under such a system of instruction was necessarily reserved for those few pupils who were far enough advanced to master and appreciate the higher classics. Such mechanical methods,—*mere* memory work,—almost universally prevalent at the beginning of this century, may perhaps still linger in a few schools, but the presence of an intelligent teacher, to give life to the 'letter' and cultivate simultaneously all the mental powers, is now, happily, a generally admitted necessity.

Young David gained all the advantages which the Paisley Grammar School was able to afford. His mild disposition usually led him to avoid the more boisterous sports of the playground, though he was physically equal to the roughest games of his companions. The 'fair-haired youth' was remarkable for vivacity and buoyancy, but preferred, nevertheless, to associate with the 'gentler few' of his playfellows. His delight was 'to *observe* the amusements of his companions and witness their happiness;' and he began early to evince those powers of rapid observation and almost intuitional inference by which he was in after life distinguished.

The influence of school life on the formation of character no parent can afford to disregard. Still, the chief formative forces should be found in the family circle. A parent possesses a power which it is impossible to delegate to another. That power involves privilege as well as responsibility. 'Train up a child in the way he should go' was a command to which is attached a promise which was implicitly believed by David's parents—'when he is old he shall not depart from it.' The habits of their household were regulated by Christian principles. 'The duties of the magistrate's office, the pressure of business, and the claims of social life, were rarely permitted to interfere with regular religious exercises, and the special study of the Scriptures in a weekly meeting of earnest men, held in the father's house, impressed the observant children's minds;' whilst the 'fervent prayers and patriarchal gravity persuaded them of the reality of religion, and the memory of these hallowed assemblies lingered long amid the vicissitudes of after years.' Mrs. Stow's piety, though unobtrusive, was impressive and controlling. 'The mother's influence was with young David, as it has been in countless instances, a privilege of unspeakable value.' The whole family felt those subtle and silent forces which most tell on the opening history of childhood and youth. Among the most welcome of the visitors was the Rev. Dr. Love, whose life—'a living epistle'—the young observer studied with profit, gaining thence strength and courage, whilst as yet he was unable to understand the doctrinal discourses on the Sabbath-day. The hallowing influences of home constituted the most valuable part of David Stow's training, and prepared him for his future work.

At the age of eighteen Mr. Stow entered the service of a Glasgow firm, and the circumstances of his new position were such as to test the strength of the principles which he had learnt beneath the parental roof. By an early and wise choice of congenial companions his moral courage was strengthened, and he not only

* The writer of this article is largely indebted to the work of his friend the late Dr. William Fraser, of Paisley, entitled 'Memoir of the Life of David Stow,' which was published in 1868, by Mr. James Nisbet, Berners Street.

remained steadfast and unmoveable amidst the subtle and syren influences by which he was surrounded, but became also the centre of a Society which, as he then wrote, should form 'an asylum for those who were struggling between a father's advice and those with whom chance may have led them to associate.' He was among the foremost to support missionary enterprise in heathen lands at a time when it was unpopular. The needs of 'the neglected' in his own city, however, stirred his utmost sympathy, and nerved him to resolute effort for their relief. Within twenty years Glasgow had doubled its population, and the immigrant 'families were huddled in masses together in miserably unsuitable homes,' sinking, morally, from bad to worse. His daily duty led him through the Saltmarket—the St. Giles of Glasgow—and in the presence of 'shameless profanity, indecency, and filth,' the question pressed with growing urgency upon his mind and heart, 'Can nothing be done to stem this deepening torrent of degradation and vice?'

Mr. Stow's experience as almoner of funds for the relief of the poor, convinced him of 'the comparative hopelessness of every effort to reclaim the old.' 'An amount of deceit, ignorance, and wickedness was gradually revealed, which convinced me that the favourite idea of reclaiming the old was a hopeless one. . . . No motive aroused them till the silver pence were presented; this lighted up their eye and warmed their heart. . . . Habits, our second nature, held them as with an iron grasp.' He resolved, therefore, to try his first experiment with the young, who, 'because most plastic,' were most hopeful.

Sabbath-schools were at that time suspected as being a political organization. When, a few years previously, Mr. Stow's father had formed a Society to institute such schools, the Sheriff of Renfrewshire requested the teachers to register their names at the Fiscal's office and take the oath of allegiance. Mr. Stow was thus prepared for any lack of sympathy with the establishment of a Sabbath evening-school: but, in the strength of his convictions, he persevered, nothing daunted even by the avowed hostility of influential persons who denounced his 'fanaticism' and 'excessive zeal.' Vagrant children were gathered at random, in the first instance, from the 'front streets only;' but as their residences were distant and far apart, it was found impossible to bring personal influence to bear upon their homes by frequent visitation. Another plan was therefore adopted. Two densely-peopled lanes in the Saltmarket, containing about seventy families, supplied about thirty boys and girls, and twice a week Mr. Stow visited their homes and gained the confidence of the parents, who thus became personally interested in the success of the school. The visible results of his labours in this debased district where there was a 'sad community of ignorance, rags, and filth,' were in every respect encouraging to the patient teacher; and the adoption of the local system of Sabbath-schools by Dr. Chalmers was consequent on this successful experiment of the youthful enthusiast. At that time Mr. Stow 'believed this system itself to be adequate to the regeneration of the people.' For several years, though carrying on an extensive business, this young merchant, by a strict economy of time, was able to give much assistance to Dr. Chalmers in working out many schemes of benevolence. He was appointed a deacon in 1821; and, notwithstanding the great difference of age, became one of the Doctor's most intimate friends. His best energies, however, were given to the establishment and working of schools; and when, after lengthened experience, he found that facts did not confirm his 'faith in the efficiency of the Sabbath-school system to renovate the whole social fabric,' he began to plead for the training of the young during the whole week, so that the six days' training to evil in the streets might no longer counteract the effect of the brief period of the one Sabbath evening. He tried to persuade all whom he could influence of 'the necessity of changing street training into school training, and of bringing the power of habit during the whole week to the side of religion.' This conviction led ultimately to the development of the Training System, whose principles and methods are based on the 'power of habit.'

There was one feature in Mr. Stow's Sabbath-school work which merits attention and imitation by those who would attain a like success. An earnest desire for the welfare of the children in his school led him to study all the circumstances under which their characters were moulded. His system of visitation unfolded many a page in the social volume, which instructed him how the better to restore life and blessing where what remained of good was 'ready to die.' Families were gladdened by his sympathetic voice, and his unsparing efforts for the welfare of the younger members ever secured a cordial welcome. 'Don't go with a paper in your hand,' said he, in his own cheery way, to the young visitors; 'the people will have an idea that you are collecting taxes. Knock at the door, tell pleasantly your purpose, and speak kindly to the children. The way to the parents' heart is through the child. You might as soon send a lion or a bear to attract children as some visitors whom I have seen. Do not speak to parents and children as if you had on a soldier's collar. Don't be gloomy; and remember also you will never get children to look confidingly to you with your chin buried solemnly in your bosom.' His own visits were said to have an abiding charm, and in the dark slums, where he carried on what he quaintly called his 'deep-sea fishing,' he succeeded in dredging up from the lowest social depths many a sinking or sunken one in the network of his good-natured and Christian sympathy.

The 'sunken classes' were not only callous, but coarse; and the vulgar cruelty of the young foreshadowed the probable future. Mr. Stow's first experiences were not encouraging. 'On the night of his opening his school he encountered much rudeness. No sooner was the class arranged, and had prayer begun, than the lights were extinguished. When rekindled, Mr. Stow was alone; the class had escaped. He cheerfully resumed his visiting of every family, and, without uttering a single complaint, he won back all his pupils and secured obedience.' 'A bold and restless boy, ragged and barefooted, had entered the class; lines, the shadows of cunning, were already traced on a naturally frank and open countenance. Placed on the third seat from the front, the temptation was great, and he yielded to it. Having ingeniously taken hold of a large pin with his toes, he darted it against the bare feet and legs of as many as he could reach of those before him; they leaped yelling from their seats, and he stood in their midst apparently alarmed by this unexpected turmoil. On discovering

his conduct, Mr. Stow neither denounced nor expelled him, nor did he adopt the clumsy expedient of sending him to another seat; but he reasoned with him as to the pain he had thoughtlessly given his classmates, and as to its continuance after his fun ended. He appealed to his sympathy and won it. In the course of a short time he gave him charge of the candle-lights, and by no awkwardness in snuffing them were they ever afterwards extinguished. The boy became an enthusiastic scholar.'

These incidents show that Mr. Stow possessed one of the chief elements of a true teacher's moral character. 'Gentleness, patience, and reasoning, even with such rude boys, proved to be a greater power than the rod, and he repudiated both corporal punishment and expulsion. In every instance of obstinacy, his mild, yet firm and decided looks and words speedily effected what neither blow nor bawling could have so fully effected.' One frequent resource was private reasoning with offenders, and he thus secured from them almost invariably a more consistent obedience than the harshest measures could have compelled. To most of his Sabbath scholars such kindly treatment was a new experience. 'He appealed to the higher principles of their nature, impressed them by the power of the Word of God, and overawed them by the solemnity of prayer. He succeeded in winning them to order and truthfulness, and to a respectful obedience, which was chiefly based on love to himself.'

The mode of conducting the class was new in other respects. Mr. Stow always explained the meaning of the psalm to be sung, or of the verses of Scripture, *before* they were committed to memory. In these efforts to impress divine truth on the mind, he discovered the value of vivid illustrations, and developed the method of 'picturing out in words.' Happy in himself, and happy in his work, 'the class was happy in his presence. The attention and interest of all were sustained by his close questioning, and he stimulated the thinking power of each by affectionate liveliness, impressiveness of manner, and the striking nature of the varied illustrations which he used.'

When younger children were introduced to the class, 'it was found there was a lack of sympathy between those of different ages.' The little ones were taught separately, and Mr. Stow then noticed what he termed the 'power of sympathy among children of nearly the same age,' and afterwards applied it in his System as an aid to instruction and to moral training.

Mr. Stow witnessed with satisfaction the gradual establishment of kindlier relations between the different ranks of society, as one happy result of his school; but, amid the incessantly active forces of evil, the need of day-schools, permeated with the spirit of the truly Christian Sabbath-school, was constantly pressed upon his mind. In 1824 he began to urge this conviction upon his friends; and, in 1826, ten years after he had begun his work in the Saltmarket, he founded the Glasgow Infant School Society, with the object of *training* little children in week-day schools on the principles and methods which had been independently developed in his Sabbath-school. A house and garden in the Drygate were taken on a short lease. A 'gallery' of raised seats accommodated about a hundred children, and the garden was turned into a playground, which, as an 'uncovered schoolroom,' was, in Mr. Stow's view, a *necessary* complement, as affording opportunity for the study of character. Mr. David Caughie, a young man of Stranraer, was selected as the first teacher, and soon gave full evidence of his fitness. 'Earnestly devoted, loving his work as a Christian teacher, patient, lively, buoyant of spirit, and lightening his labour with fitful gleams of natural humour, he soon proved a model infant trainer, gained the respect of the directors, and faithfully represented in practice Mr. Stow's principles.'

This obscure school-house was the first home of the Moral Training System, and it was in this college in the Drygate that teachers first received systematic training for their work.

Under the new system the pale, ill-clad, and ignorant children soon became healthful, cheerful, and intelligent; and, as these results became known, a selected number of little ones were, on invitation, taken to several towns to attract the attention of the public, and thus to promote the extension of the system. The plan was in this respect very successful, and 'Trainers' from the Drygate Training School were soon required for many important places in Scotland.

To conciliate the more thoughtful working classes, and to explain in a popular way the principles of the 'new-fangled schooling,' Mr. Stow about this time (1829) wrote in admirable Scotch a dialogue entitled 'Granny and Leezy.' The following extract will be interesting not only on educational grounds, but as showing a ready insight into character, and a power of delineation 'even in its subtler forms with humour and exactness':

[*Granny visits the Model School for training Infants, raps* (knocks) *at the outside gate of the Play-ground, which is opened by the Children at Play.*]

Granny. Weans, is this the schule?

Weans. The Infant School do you mean, Mem?

Granny. Ay, to be sure—let me in, my braw bairns.—Whar's the Maister?

Weans. There he's, Mem, at the other end of the play-ground, near the school; he was just swinging a little with the boys.

Granny. Swinging—swinging—Maister an all—A fine schule to be sure—let me see him.

Weans. Take care, take care, Mistress, else the boys will knock you down, for they're swinging.—*Twenty-eight—twenty-nine—thirty.*

Granny. What's that they're saying, Weans?

Weans. They're counting their turns, Mem.

Granny. Counting their turns! what can that mean?—Let me out o' the road, Weans. Ye're just like a skep o' bees, ye wee tots—tak' care my staff disna hurt your taes, ye wee bits o' things—stand a' back noo, but ane—ane's eneugh to let me see the Schulemaister. (Mary runs to meet her grandmother.)—Granny.—*Is this you, Mary,—my bonnie thing?*

Weans. *Mary says this is her ain Granny.*

Master. Come in, Mistress, you seem fatigued—you had better take a chair near the fire, and rest a little.

Granny. Deed, I hae muckle need to rest, there's sic a crowd in this place; it's just like a 'cried fair.' Deed, I was amaist like to be knockit down, gin it wasna for the flock o' weans, who were very ceevil, puir things, takin' me out o' the road.

Master. Just rest a little, if you please, while I call in the children from the play-ground. After each hour or half-hour's lessons in the school-room, we allow them a few minutes out-of-doors, to play.

Granny. Weel-a-weel, play's a' richt, but what's half-an-hour to do in the way o' perfecting in reading? In my young days, we sat hale three hours at a time in the schule, and durstna turn the side o' our head a' the time, for fear o' the taws whiskin' past our lugs, (ears,) and maybe a loofie (palmies) or twa to the bargain—but we'll see, Maister. Now, to be honest wi' ye, I hae just come this morning to search to the bottom o' this thing; for I hae twa oes (grandchildren) in this schule contrar' to my will, and I ha'e their spiritual weelfare constant at heart;—and frae a' I ha'e heard, I canna say that I'm just owre weel pleased wi' what I hear.

Master. Well, Mistress, I like candour; and if you will have a minute's patience till the children are all in, I shall be happy to——

Granny. Stop there, Maister—stop. I see by your een ye're going to wheez me o'er wi' a word o' flattery; but mind ye, lad, that'll no do.—Schulemistress, stop the weans frae coming in at

the door there, till I get my breath out; that maun I. Maister, steek (shut) the door, gin ye please.

Master. Well, Ma'am, the door is shut. What important matter is now to be brought under discussion?

Granny. Decussions, or what ye like; I want, Maister, to speer a plain quastion. Whatfor do ye, as I'm tauld ye do, bring down a maister's dignity, and condescend to play wi' weans, swingin' and lampin' round *a big stab* there, like a muckle gawky? What commaun' can ye expect to ha'e after sic pranks?—Answer me that, Maister, and tak' care what ye say, for they tell me there's nae lecing here, and I'll be a witness to the truth o' the observe—that will I.

Master. Now, Mistress, when you stopped me so abruptly, I was about to have said, that I shall explain everything to you; and it will afford me much pleasure showing our plan of teaching and training to a person of the venerable age you appear to be.

Granny. *Nae glamour noo*, Maister,—to the point, if ye please.

Master. Well, Madam, respecting playing with the children, you know the first and most important object, in rearing up children 'in the way they should go,' is to gain their affections.

Granny. O ay, that's true, but what syne?

Master. And we think this important point is more easily and effectually gained, by being quite at ease with the little ones, rather than by keeping at a distance, and awakening fear in their tender breasts, instead of love. You will acknowledge, I believe, that the service done to a person you love is more heartily performed, than when fear is the animating principle. You will recollect, Madam, it is said,

> 'Love still shall hold an endless reign,
> In earth and heaven above,
> When tongues shall cease, and prophets fail,
> And every gift but love.'

Granny. Ay man, I see ye hae gotten some o' the Paraphrases by heart—that's sae far, to be sure; but swingin' on ropes—whatfor that, Maister, ken ye?

Master. Well, I was about to have said, that we conceive one most distinct method for parent or school-trainer to gain the affections of children under their care, is to enter into all their little amusements, at least occasionally. Children highly value this condescension on the part of their teachers, and the contrast in age is so great, that no child will respect a teacher the less on account of having had a game at ball with him, or even a swing, to which you seem to have such mighty objections; but, on the contrary, I would say, to offend such a master or parent would be a matter of regret on the part of the children. Under such circumstances, he is an object of love, but never of terror. You know that God in Christ has condescended to many of our weaknesses and infirmities, in order to gain our affections—though never to our sins. With these God could have no sympathy.

Granny. Sins, sins—na, na—God couldna do that. I was amaist fear'd ye were gaun wrang, lad—but ye brought yoursel' out no that ill at the hinder end—tak' tent o' thae kittly bits: na, na, God never can look at sin but wi' the outmost abhorrence.

Master. Madam, I find the children must be let in. They have been quite long enough in the play-ground, and I fear it begins to rain. I shall ring the bell, and the mistress will lead them all in.

Granny. Come awa,—come awa,—ye wee tots—what a flock! I'se warrant there's twa hundre' amaist.

(To be continued.)

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'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

Head Master of the Gloucester Road Board School, London.

FOURTH-SCHEDULE SUBJECTS: MECHANICS.

IT has always appeared to me that the main work of an educator is to teach 'how to think.' This is, indeed, nothing else but to train human beings to become in reality something different from the lower animals. But before we set about this 'development of the powers of mind' as we call it, would it not be well for us to know at least a little about this 'mind?' A teacher altogether ignorant of psychology is to a great extent working at random. Every reader of the *Governess* most surely has seen in those able articles of Mr. Coupland's on the 'Discipline of the Mind,' how intimately the principles of psychology are connected with the principles of education. In fact, as gravitation is the key to the physical sciences, and evolution the key to the biological sciences, so most assuredly is psychology the key to the science of education. Most of the superstitions, whether political, religious, or scientific, that now hang over us like thick black clouds, will vanish as soon as we teachers have educated the masses 'to think.' In these lessons the reader will by this time have seen that I have always proceeded in this sequence:—1st, the boys observe; 2nd, they experiment; 3rd, by experiment they ascertain facts; 4th, they put facts together, draw conclusions, and so arrive at laws. I think this is the true scientific mode. At least I know that this is the manner of investigation adopted by our leading men of science:—Darwin, Tyndall, Huxley, etc. And why should not we, in our humble way, when working out our little conclusions with the boys, follow the same method? Those teachers who are content with teaching only the laws and conclusions of No. 4, do but instruct; those who, in addition, pass through stages 1. 2, and 3, also educate.

The following is an outline of a lesson upon the 'inclined plane.' The apparatus figured in No. 5 PRACTICAL TEACHER stands upon the table. The references are of course to that illustration. The screw W and the block X are removed, and the plane is placed so that A_3 is at Z; and A_4 on the brass rod V in the top hole. I begin the lesson.

Did any of you boys see some men bringing heavy barrels into the playground this dinner-time? Ans.—Yes, sir, they are going to put some new asphalte in the playground. Yes, but you are not quite right; it is tar-paving, not asphalte, they are going to put down. Well, did you see the men trying to lift the barrels up the step by the door? Yes, sir; three men tried at one barrel. Could they do it? Ans.—No, Mr. Marlow went and got a board. Well, what then? Ans.—They put one end of the board on the step, and then two men rolled up the barrel. Two men? Ans.—Yes, sir. And you say that three men could not do it without the board. Have you ever seen something like this done before? Ans.—Yes, sir. I saw some men getting a large barrel of sugar into a grocer's shop. I saw two men rolling a large barrel up into a brewer's dray. Very well. Why did these people adopt this plan of raising the barrels? Ans.—Because they found it easier than by lifting them up by hand. Supposing the men could not have rolled up the barrels of tar even with the board Mr. Marlow brought, do you know what they would have had to do? Ans. (after a pause).—They would have had to get a longer board. Just so. How much do you think one of those barrels weighed? Ans.—About two hundred-weight. Yes, a little over that I should say. Well, do you think the men pushed with a force of two hundred-weight to get the barrel up? Ans.—No sir, less. How much less? No answer. Well, let us try to find out by experiment how the matter stands. Perhaps we shall be able to find out exactly what this gain of power depends upon. Here you see is an inclined plane (Fig. 3). It is three feet long, and the end (A_4) is raised just one foot. We will call this 'one foot' the perpendicular. What is the ratio of the perpendicular to the length to the plane? Ans.—As 1 to 3. Very well. Farmer, you can come out this morning and write the notes on the board. Put

down, perpendicular height is to length of plane as 1 to 3.

Per. : Len. of Pl. :: 1 : 3.

You see we have a small carriage, it weighs exactly one pound. Put that down, Farmer. Jones, you can come out here. Now I am going to let Jones put various weights in the carriage and see what weight hanging on here (A_3) will balance, then we shall be able to say what is the exact weight that will draw up the carriage. But before we do this, is there not something else we must settle? Ans.—Yes, sir; there's the weight of the carriage. Ah! yes, but we can always add one pound for that. (Another boy)—There's the friction of the wheels to take into account. Very good, Smith, that is just what I wanted to get at. Now, how shall we find out what to allow for this friction? Ans.—See what weight will draw up the carriage by itself. (Another boy)—No, that won't do, because that would be taking into account the weight of the carriage as well. Of course it would, Howell; then what must I do? Ans. (Howell)—Put the plane quite level, then see what weight will draw it along. Very good. Jones, take out the brass rod, place it in the third hole, now put the other end of the plane on the block (Z). Now it is level. Put on a weight (at A_3). You see we hav'nt one small enough; try this penny. It is quite enough to draw the truck along. There is so little friction, therefore, that we need not take it into account at all. Why, think you, is the friction here so little? Ans.—Because you have put down rails on the plane. (Another boy)—And have brass wheels. (Another boy)—That is why they put down rails for the tram cars. Yes, and on the railway as well. (A boy)—That's why it's called a railroad. (Another boy)—Nearly all the roads are railroads now. Very well; now, Jones, place the plane as it was at first. Now put a two-pound weight in the truck, see what weight at A_3 will maintain equilibrium, or balance the truck in the middle part of the plane. Ans.—One pound. Good. If we let the weight at A_3 represent the power and the truck the weight, tell me what *is* the power. Ans.—One pound. And the weight? Ans.—Three pounds. Farmer, write that down. Farmer writes—

P = 1 lb. W = 3 lbs. or as 1 : 3.

Now place this six-pound weight and this five-pound in the truck; how much in all? Ans.—Twelve pounds. Now, Jones, find what weight will balance. Ans.—Four pounds. Good. Farmer, write that down. Farmer writes—

P = 4 lbs. W = 12 lbs. or as 1 : 3

Very well, now both go to your places. I will now put a nine-pound weight in the truck, perhaps you can tell me now what weight I must put on to balance. Ans.—Three pounds. How did you know that, French? Ans.—Because the power is always one-third of the weight. (A boy, Howell)—It is *there*. What do you mean, Howell, by saying 'it is *there*?' Ans.—It's a third there, because the height of the plane is a third of the length, but if you put the brass rod down another hole, it won't be so. Now look, boys. Howell says this: that with the height as it is now, three pounds balances nine pounds, but if I lessen the height, it would not be so. Well, Howell, come out here: shift the brass rod to the second hole; you now have the height half a foot. Find what weight will now balance. Ans.—One and a half pounds. You see, boys, Howell is right. (A boy)—Please, sir, the less you make the height, the less the power is. (Another boy)—I can see the rule. Can you? What is it? Ans.—When you had the height one-third of the plane, the power was always a-third of the weight, and when you had the height one-sixth of the plane, the power was one-sixth of the weight; so the power is just the same part of the weight as the height is of the plane. You have the right idea, Drayson; now can any boy come and write what Drayson says, as a proportion? Let 'h.p.' stand for the height, and 'l.p.' for the length of the plane. No one can do it? Well, listen; we have been talking about four quantities, viz., the weight, the perpendicular height of the plane, the power, and the length of the plane; I want some boy to come and write out those four quantities in the form of a proportion. (A boy)—I can do it, sir. The boy writes—

P : W :: h.p. : l.p.

Very good. Now suppose the weight is 100 lbs. and the height 4 feet, and you can employ a force or power represented by 10 lbs. only, what length must the plane be? Drayson writes—

10 : 100 :: 4 : l.p.

$$\therefore \text{l.p.} = \frac{100 \times 4}{10} = 40 \text{ ft.}$$

You see, boys, this proportion will enable us to work any sum about the inclined plane. The boys who are out can now go to their places. All copy into your books what is on the black-board.

(To be continued.)

—o—

Practical Lessons on Insect Life.

BY THEODORE WOOD, M.E.S.,

Joint Author of 'The Field Naturalist's Handbook.'

NO. XV.—THE DIPTERA.

BETWEEN the *Homoptera* and the *Diptera* is placed the small and comparatively unimportant order of the *Aphaniptera*, the members of which are popularly known as Fleas.

The word *Aphaniptera* signifies 'non-appearing wings,' and is a very appropriate title, the organs of flight being utterly useless for their legitimate purpose, and being merely represented by four extremely minute scales upon the thorax. So small are these scales, indeed, that they can only be seen by means of a high power of the microscope, and even then are so unlike the wings of other insects that their real nature would scarcely be imagined except by an entomologist experienced in insect anatomy.

Space being unfortunately limited, we can devote but a few lines to this order, which, although unimportant and comprising comparatively few members, yet affords us many features of interest. We will therefore pass to the *Diptera*, or two-winged flies, which constitute the last order in the present classification of the insect world.

The word '*Diptera*' is not as appropriate a title as might be desired, being of a rather misleading nature. It is true that in the insects of this group two wings only are visible upon a cursory examination.

But this is in outward seeming only, for all four wings are present, although the lower pair are found in a curiously modified form. Few, indeed, would recognise these for wings, or modifications of wings at all, the two tiny bristles, each tipped with a small round knob, apparently having nothing in common with the broad, membranous organs which bear their owner so swiftly through the air.

Yet, small and unimportant as these '*halteres*,' or 'balancers' appear, they yet seem to be of vital importance in the flight of the insect, for it has been found that if they be removed, or otherwise damaged, their owner loses the power of directing its course, and can only flutter helplessly along the ground, like some moth whose too inquisitive turn of mind has led it to practically experience the properties of a gas-flame. Even in many Diptera, whose upper wings are only rudimentary, the halteres are present, which would lead us to suppose that they have other functions besides that of assisting in flight, and of which we can form no conjecture.

The upper pair of wings are of much the same nature as are those of a bee or wasp, but have at their bases two small appendages, looking somewhat like an additional pair of rudimentary wings. These are generally known as 'alulets,' or winglets, the object of which is not clearly understood.

Professor Westwood has divided the *Diptera* into two great sections; the first of which he terms *Cephalota*, the head being distinct from the thorax instead of being sunk into it. This group he again divides into smaller families, the *Nemocera*, or 'Thread-horned' flies holding the first place in his arrangement. In the insects of this group the antennæ are composed of more than six joints, the palpi having either four or five joints.

This division includes some of the most widely and universally familiar of all of our British *Diptera*, namely, the gnat and the daddy-long-legs.

In spite of certain unpleasant features in the character of each, both these insects are of wonderful interest, and will repay the most careful and protracted examination which can be bestowed upon them. We will begin with the former, known scientifically as *Culex pipiens*.

Excepting by those favoured individuals who are exempt from its attacks, the gnat is generally regarded as an insect whose sole mission in life is to torment the human race, and therefore as one which should be discouraged in every possible way. And yet, like many other creatures placed in the same category, the gnat is far less black than it is painted, and, indeed, by the nature of its food during the earlier stages of its existence, actually confers a benefit upon mankind by preventing miasma from arising from the putrid substances found in the stagnant ponds in which it dwells.

The life-history of the gnat is of a most wonderfully interesting nature, from the moment at which the eggs are deposited by the parent until that when the perfect insect emerges from its pupal shell, and soars aloft to make its first journey through the air, of which, for the remainder of its existence, it is to be an inmate.

To begin with, the eggs are deposited upon the surface of the water in a very singular manner. Resting upon some small twig, or other floating object, the parent gnat crosses her long hind legs behind her, and places a single egg in the angle formed by their junction. This egg, which is long and spindle-shaped, is then transferred to the water where it floats upright, little more than half being actually submerged. A second follows in a like manner, and is firmly fastened to its predecessor by some cement which is not affected by the action of water. This is in its turn followed by a third, and so on until the whole number of its eggs is deposited.

When this is the case, the egg-mass is seen to form a kind of boat, much resembling a carraway seed, both in size and appearance. This floats upon the surface of the water, and, by the peculiar method of its construction, can neither be sunk nor upset. It may be forcibly submerged, but will return to the surface immediately upon being released, and, discharging the water which it had taken in, at once regain its former position. Indeed, the whole structure of the egg-boat of the gnat is so exactly that of the present self-righting lifeboats that we cannot but wonder whether the inventor of the latter did not take a lesson from nature, and build his boat upon the principles of one which probably existed long before man came upon the face of the earth.

After the expiration of a few days a small door, so to speak, opens in the submerged end of each egg, and the young gnat larva dives into the water which is to form its home throughout the earlier stages of its existence.

The appearance of the young grub is rather remarkable, the head being very large when compared with the size of the body, and the tail furnished with a forked appendage, connected with the respiratory apparatus. These larvæ may be found in numbers during the summer months in any stagnant pool or ditch.

In due course the larva passes into the next stage of its development, and becomes a pupa. It is still able to travel through the water as before, but can no longer take food, all the organs of the mouth being enveloped in the outer covering. After a short time, the pupal skin cracks along the back, and the perfect insect slowly emerges, using its late covering as a kind of raft upon which to rest until the wings have attained their full strength, and are able to bear their owner into the air.

Just as is the case with the bee and wasp, and other stinging *Hymenoptera*, the male gnat is altogether harmless, and is quite incapable of inflicting the unpleasant wounds caused by his gentle spouse. The distinction between the sexes in outward appearances is evident even to a casual observer, for the antennæ of the male are beautifully plumed for almost the whole of their length, while in the female these organs are feathered only in a very slight degree.

The apparatus by which the female gnat inflicts the wounds which cause her to be regarded with so great abhorrence by the victims of her attacks is of a rather complicated nature, and cannot be very easily described by words alone. The beak consists of no less than seven separate parts, which are, in fact, modifications of the different parts of the mouth, and are not supplementary organs, as is generally supposed to be the case. The upper lip becomes a broad and hollow lancet: the mandibles are developed into long serrated organs, adapted for the purpose of piercing the skin; the maxillæ are somewhat similar in form, but are very much more slender and delicate; the tongue, again, is represented by a very long and needle-like

instrument, while the lower lip forms a kind of sheath which encloses these various weapons when not in use.

The peculiar irritation caused by the bite of the gnat is due to the saliva, a small portion of which is introduced into the wound by the insect in order to cause the blood to flow more freely. This acts with greater or less severity upon different individuals, some suffering greatly from the bite of the insect, while others seem little, if at all, annoyed by the wound.

When placed beneath a tolerably high power of the microscope, the gnat becomes a most wonderful and beautiful object, fully repaying any care and attention which may be expended upon its examination. The wings, the body, the limbs, and even the beak itself, are seen to be covered more or less closely with beautiful scales, very much resembling those of the Lepidopterous insects which have been described in preceding papers of this series. All the colours of the rainbow seem to play over the body, while new glories show themselves at each fresh glance, giving the observer some slight and imperfect idea of the wonderful beauties to be found even in the commonest and most despised of the inhabitants of the insect world.

The well-known Daddy-long-legs, or Crane-fly (*Tipula longicornis*), must be ranked amongst those insects which are directly injurious to man, the larvæ feeding upon the roots of various grasses, which in some cases they so destroy that the turf may be rolled up by the hand as readily as if it had never been attached to the ground beneath. Indeed, were it not for their natural enemy, the starling, the damage caused by these grubs would be altogether incalculable, and would well entitle them to take rank amongst the bitterest foes to our lawns and pasture-land. Even as it is, they are quite destructive enough, and in some seasons swarm to such a degree that acres upon acres of grass land are completely ruined by their depredations.

There are many species of crane-flies, some of which, like the gnat, are inhabitants of the water until they attain to their perfect condition. In one genus, *Chironomus*, these grubs are of a bright scarlet colour, and are sometimes the cause of a somewhat peculiar, and at first sight mysterious, phenomenon. In damp and marshy ground, perhaps a small pool or two may be seen in which the water appears to be of a dull reddish colour, just as though a considerable quantity of blood had been mingled with the contents. As the observer approaches, this red hue suddenly vanishes, and the water assumes its normal appearance. Should he remain quiet, however, the reddish colour gradually returns, until the pool appears just the same as before his approach.

This strange phenomenon is due to the scarlet grubs of the *Chironomus*, which are present in such numbers as apparently to redden the water of the pool. At the least sign of danger they dive into the mud beneath, remaining there until quiet is again restored.

THE next division of the Cephalote *Diptera* is known as the *Brachocera*, a word signifying 'short-horned.' In these flies the antennæ never consists of more than three joints, while two, and in some cases one only, are found in the palpi.

A well-known member of this group is the Gad-fly (*Tabanus bovinus*), which forms so great an enemy to cattle in this country. It does not, however, confine its attacks to these animals alone, but often forms a very unpleasant foe to man himself, driving its long and sharply-pointed lancets into his skin, and inflicting a decidedly painful wound. As is the case with the gnat, the male is harmless, all these unpleasant attacks proceeding from the female alone.

On account of its wonderful likeness to a bee, the Drone-fly (*Eristalis tenax*) would scarcely be taken for a dipterous insect at all, and there are few people who would care to handle a specimen until they were thoroughly assured that the resemblance ended with its outward appearance.

The chief interest of the drone-fly lies in the larval stage of its development, at which period of its existence it is certainly a most wonderful creature. It is then known as the Rat-tailed Maggot, a title which it derives from the very curious formation of the respiratory organs.

Dwelling, as it does, immersed in the most fetid and noisome mud which can well be imagined, the requisite supply of air would seem to be utterly unattainable. But this difficulty is overcome by the remarkable structure of the tail, through which the breathing tubes run, and which bears a wonderful resemblance to a telescope, being capable of considerable expansion and contraction. Thus, although the whole body may be completely buried in the mud, the extremity of the tail can yet project above the surface, so that a constant supply of air is assured to the larva.

Should any signs of danger appear, this telescopic tail is instantly contracted, and does not resume its functions for some little time.

Taking into consideration the nature of its food, we may rank the drone-fly amongst our more particular insect benefactors, for there can be no doubt that by its agency a vast quantity of putrid matter is annually consumed which would otherwise in all probability give rise to miasma, and so cause fevers and agues to a very considerable extent.

When the time for its change to the pupal condition approaches, the drone-fly larva emerges from the mud which has previously formed its home, crawls ashore, and buries itself in the ground, whence the perfect insect emerges in due time. The fly is extremely plentiful, and may be found in great numbers throughout the summer and early autumn, either hovering over flowers, or basking in the warm rays of the sun.

Passing of necessity by many very interesting insects, we come to the vast family of the *Muscidæ*, more than a thousand species of which are known to inhabit Great Britain alone. Of these we will take two or three examples, the first of which shall be the common and well-known Blue-bottle, or Blow-fly (*Musca vomitoria*).

This is another of the many insects which are popularly supposed to be created for the sole purpose of annoying mankind, whereas in reality their services can scarcely be over-valued. It is true enough that the blow-fly is very troublesome in our larders during the heat of the summer, but, if we set this trifling annoyance in the scale against the great benefits which it confers upon us in other ways, we shall see that it ought in reality to be placed in the foremost rank of our insect friends.

For the blow-fly is one of the most untiring coadjutors of the burying beetles, the cocktails, and the various other insects whose larvæ find their food in decaying animal matter, and which ought, therefore, to be protected and encouraged to the utmost of our power.

No sooner does any neglected animal matter show the least signs of incipient decomposition, than the blow-fly, together with its many assistants, makes its way to the spot, and commences its beneficent work by depositing a vast quantity of eggs. These very shortly hatch, and the young grubs immediately begin upon the great business of their lives, viz., that of eating, from which they never cease until the time arrives for them to assume the pupal form. They then bury themselves in the ground, and become hard, cylindrical, brown objects, not quite a quarter of an inch in length. In a wonderfully short time the perfect insects emerge, and at once set off in search of sustenance for the next generation.

The Flesh-fly (*Musca carnaria*) greatly resembles the blow-fly in habits and life-history, differing from it, however, in one important particular. For, while the blow-fly places eggs upon the putrid matter which it selects as food for its future offspring, the flesh-fly deposits living larvæ, these having hatched within the body of the parent. If the abdomen of a flesh-fly be opened, these grubs may be seen lying in two long rolls, each of which contains some five thousand larvæ.

The wonderfully rapid rate at which these flies multiply may thus be imagined, and when we reflect that the entire development of the insect is completed in the course of a day or two, we can understand the remark made by Linnæus, that three flies could eat an ox as fast as a lion.

Many of the *Muscidæ* are parasitic within the bodies of various caterpillars, just as is the case with the Ichneumon flies described in a previous article.

We must not omit to mention the well-known Bot-flies (*Œstridæ*), so familiar to us from their parasitic attacks upon various animals.

One of the most plentiful of these is the common bot-fly (*Gasterophilus equi*), which always selects the horse as the victim of its attacks.

The egg is placed by the parent insect upon some hair within easy reach of the horse's tongue. Before long, the spot is licked by the animal, and the egg carried into the mouth, whence it shortly passes to the stomach. Here the grub emerges, and seems to feed upon the secretions of that organ.

During the winter it remains within the body of the horse, but in the spring loosens its hold, passes through the intestines, and makes its way to the ground, in which it burrows in order to assume the pupal condition.

It is a mooted point whether these larvæ, many hundreds of which may often be seen within the stomach of a single horse, are productive of harm to the animal. It can hardly be supposed that their presence within the body can be beneficial, and yet it is impossible to detect any actual harm caused by their parasitic habits. As, however, it would seem that they must extract a certain amount of nourishment from the secretions of the stomach, we can only conclude that they must, although, perhaps, in only a slight degree, weaken the animal in whose body they have taken up their abode.

A curious memorandum with regard to this group of *Diptera* occurs in the *Entomologist* for July of the present year (Ent. xv. 164):—"At one of the meetings of the International Medical Congress, Dr. W. G. George stated that a girl, aged twelve, presented herself with the following history:—About three months before being seen by a medical man an ovoid swelling appeared on the outer side of the ankle, causing her some pain and uneasiness in walking. This swelling gradually shifted its position, and slowly moved up the leg, thence towards the right axilla, then down to the elbow, and finally settled on the back of the neck. In this position a small dark spot appeared, an orifice formed; and when pressure was made around this opening, a white grub, nearly an inch in length, protruded, and escaped along with some unhealthy pus. Several other similar swellings developed upon subsequent occasions under medical observation, and the medical man extracted other grubs, exactly similar to the first specimen. No cause could be assigned for these curious phenomena. The larvæ were pronounced by competent authority to belong to a dipterous insect, although the genus could not be satisfactorily determined. There was no sufficient proof of the existence of an *Œstrus* peculiar to man alone."

We must now pass to the second of the great divisions of the *Diptera*, namely, the *Thoracocephala*, or those in which the head is buried in the thorax.

Space will allow us to describe one member only of this group, namely, the common Horse-fly (*Hippobosca equina*).

This insect, which torments horses so greatly by its determined attacks, is chiefly remarkable for its extraordinary method of reproduction. It will be remembered that in the flesh-fly above described the eggs are hatched within the body of the parent insect. In the horse-fly, however, whose offspring is limited to one, the whole growth of the larva takes place before it enters the world, in which it makes its appearance in the pupal form. This strange method of reproduction appears to be confined to this groupof insects.

We have now arrived at the end of our task, and have given a short and necessarily incomplete sketch of the insect world. In conclusion we have only to hope that some few of our readers may be induced to take up for themselves a study which is second to none in the beauty of its objects, the interest of their life-history, and the wonderful and yet simple nature of their structure; and we feel certain that none who may do so will ever find cause to regret their determination.

How I Teach Swimming.

BY THOMAS GARDNER,

Member of the London Schools Swimming Club.

BEFORE proceeding with hints on other styles of swimming, it will be well to notice concerning the use of rope and plank, that the former must be held or fixed taut, and that the latter if loosely floating would be of little if any service. The body must be at such a level that the shoulders are under water. Without weighting an unattached plank this would be evidently impossible. Again, it will not be well to suggest to lads the use of loose planks, as these are much given to turning over at but slight provocation, thus preparing for the novice an unpleasant and bewildering surprise. Given the requisite adjustment, however, both rope and plank will be found decidedly serviceable where the number under tuition is much larger than that of teachers and assistants.

For individual teaching, nothing is better than the supporting hand of a practised teacher, unless it be the suspending rope and belt. Even when such individual support can be afforded, the simultaneous drill by the head master will be equally practicable and advantageous.

But now, two or three further meetings of the Club having resulted in the acquisition by most of the members of the elements of Chest Swimming, our seventh or eighth lesson shall introduce

'THE SIDE STROKE.'

'Didn't Waterman use the *side stroke* at the last race meeting?' or some such sly little speech has from time to time betrayed Smart's impatience to practice the more rapid method. 'Patience, Fidgets; Waterman won the long final race by being equally at home with both the breast and the *side stroke;* but a good long, steady sweep, and the most natural breathing, had been well mastered before his first lesson in the quicker style.' 'Yes, Sir,' chimes in Waterman, 'and I remember how unkind I thought you to refuse to proceed beyond breast swimming till I could take the breadth of the lake in thirty instead of sixty strokes.' 'Now, lads, see; I turn on my right side, and without changing at all the action of the legs, make a very decided improvement in my rate of progress.' 'You slip through the water instead of breasting it,' says Jones, who has been wonderfully sharpened by our Swimming Lessons. 'Once again watch carefully; and now, Smart, tell us how it's done.' 'Your right hand is shot out straight before your head, edgewise in the water, with the thumb upwards.' 'But,' says Slocomb, who is much better in describing a thing than in doing it, 'your left arm was bent, Sir, with the back of your hand thumb downwards, close to your side.' 'Then, Sir,' adds Trickster, who is rapidly recovering lost ground, 'you brought the right arm round to the right knee with a strong sweep, and while it was returning to its right position, sent the water away behind, with left arms and legs together.' 'Yes, lads; only remember that the arm *beneath* you always *alternates* with the legs, while the upper arm moves with them, whether you are swimming on the right or left side; and note that if a change is really *quite* as good as a rest, when you can change from breast to right side, then to the left side, with a decided change of action for each, you ought to be able to go on swimming for ever.

'But now Waterman, Codling and Fisher, while the freshmen are dressing I should like you to practise for a minute

"THE OVER-ARM STROKE,"

which is only another variety of the *side stroke.* Instead of keeping the upper arm under water, move it into position for its stroke by a sweep through the air in a semicircle,—so;'—and my upper arm makes the curve through the air, and so down to the water, just in advance of my head. Meanwhile the entire body, the upper arm only excepted, is being propelled by the under arm, beneath the surface, the mouth or nostrils only appearing for an instant for breath during the stroke of the legs and upper arm. Even my clever young assistants find the utilizing of the right moment for breathing a somewhat difficult feat.

'This little difficulty will soon vanish, as others have done, and you will find this advantage in the *over-arm stroke,*—that even less of one's own weight has to be supported by this than by the other methods, since the entire body being much of the time beneath the surface, a greater quantity of water is displaced.'

Our meetings often wind up with

WATER GAMES,

which all have their use, and in which master and assistants are gradually joined by the apter pupils. Some are good practice in smart swimming; all tend to make the participators, master and men, more and more at home, and therefore readier for any emergency. Here is a little arrangement for the development of speed, which we call '*The Chase,*' and in which all can join who can swim moderately. Sides are chosen (any number may join), and a hollow ball, not too light, provided. A scorer, who may also act as umpire, has the names of each side, and starts the game by throwing the ball from the bank—where all are standing in line—well out into the lake. The ball touching the water, is the signal for a rush forward, and a rare struggle between the best swimmers on both sides. The ball touched, *ten* is scored to the successful boy and side. His part is now to throw the ball at least six yards, which will be raced after, and being secured, *two* is scored. The players on each side will try, of course, to play into their own hands, by throwing the ball towards their own men. The throwing itself is a little feat for beginners, and the throw is often less than six yards, or thereabouts, in which case '*no ball*' is shouted by scorer, and the ball given to the other side, who score *one.*

The side first scoring *thirty* wins, and *the best of three games,* and consequent victory is often the result of five minutes' sharp play.

As a game requiring and developing confidence, *leap-frog* may, amongst many others, be recommended. Codling and Fisher are specially clever at it. Codling *treads water*—the words exactly define the action—with his back to his companion, Fisher swimming briskly towards him from some twelve yards distance. The latter, approaching, places his hands on Codling's shoulders, pushes him well beneath the surface, and with a clever surface dive is a good twelve yards in advance of Codling by the time the latter has returned to daylight, and is ready for his 'run and leap,' alias swim and dive over Fisher, who is 'treading water,' and awaiting his friend's onslaught.

Somersaults, washing tubs, steamers, and mysteries without number, become facts accomplished by such dabsters as Swift, Smart, and Quickly,—such aptitude have these lads for tricks and sports. For my homilies on the dangers of *muddy bottoms, weeds, cold springs, currents, breakers,* etc., the park waters afford no means of illustration. Would that the dangers attending broken bottles were as little exemplified,—bottles which being brought for the stowage of 'sticklebacks,' have been detained by an ironical fate to keep them company.

Such homilies are, however, delivered, not seldom or without earnestness, for sure I am that Trickster, Smart, and Spratling *will* swim at every possible opportunity, and might, if unwarned, turn their recently acquired skill into an occasion for disaster. I will not say how many lessons we have now had; suffice it that at the very last, dear awkward old Slocomb whispered confidentially as we returned breakfastwards with flourishing towels and appetites, 'I really begin to hope, Sir, I shall be able to get across Lambeth Baths in October.'

And I believe he will.

GOING A-BLACKBERRYING.

T. CRAMPTON.

With Spirit. mf
1st TREBLE.
2nd TREBLE.
BASS.
1. Now autumn has come, a - way we will go To the lane where the rich, ripe blackberries grow; Tra la
2. Now fill ev - 'ry bas - ket, fill ev - 'ry dish! Then let all free - ly eat as much as they wish; Tra la
KEY D. With spirit. mf
la, tra la la, tra la la, tra la la, tra la la la la la la!.....
la la la la la la la la la la la la, tra la la, tra la la, tra la la!
A. t.
The bush - es are filled with ber - ries so thick; They seem to say, "Come! come hith-er and pick!" Tra la
Then homeward we'll haste, the loved ones to greet, And they shall all share our black-ber - ry treat! Tra la
f. D. mf
Symph.
la, tra la la, tra la la! tra la la!.....
la, tra la la, tra la la, tra la la!

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Cost price of whole = £24 × (17 × 14) (a) = £24 × 238 =	5712	0	0
Tot. prof. at 2½d. p. lb = 2½d. × 238 × 112 (b) = 6664od. =	277	13	4
Total price =	5989	13	4

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		£	s.	d.
Value of 1 acre	=	7	10	8
				27
,, 27 ac.	=	203	0	0
,, 2 ro. = ½ val. of 1 ac.	=	3	15	4
,, 1 ,, = ½ ,, 2 ro.	=	1	17	8
,, 20 po. = ½ ,, 1 ,,	=		18	10
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3. Compare the values of 777 articles at £3 7s. 10¾d. each, and of 923 articles at £2 15s. 10¼d. each.

		£	s.	d.
(a) Val. of 777 at £3 each	=	2331	0	0
,, ,, ,, 6s. = 1/10 val. at £3	=	233	2	0
,, ,, ,, 1s. 6d. = ¼ ,, 6s.	=	58	5	6
,, ,, ,, 4½d. = ¼ ,, 1s. 6d.	=	14	11	4½
,, ,, ,, ¼ = 1/18 ,,	=		16	2¼
		2637	15	0¼. Ans.

(b) Val. of 923 at £2 each = 1846 0 0

,, ,, ,, 10s. = ½ at £2 = 461 10 0

,, ,, ,, 5s. = ½ ,, 10s. = 230 15 0

,, ,, ,, 10d. = 1/6 ,, 5s. = 38 9 2

,, ,, ,, ¼d. = 1/40 ,, 10d. = 19 2¾

2577 13 4¾. Ans.

∴ (a) is greater than (b) by (£2637 15s. 0¼d. − £2577 13s. 4¾d.) = £60 1s. 8d. Ans.

4. If 2 cwt. 1 qr. 17 lbs cost £50 11s. 4d., how much can be bought for £18 7s. 6d.?

£50 11s. 4d. : £18 7s. 6d. :: 2 cwt. 1 qr. 17 lbs. : ?

or 12136d. or 4410d. or 269 lbs.

$\frac{269 \text{ lb} \times 4410}{12136} = \frac{1186290}{12136}$ lbs. = 3 qrs. 13 lbs. 11 oz. 15 1288/3034 drs.

FEMALES.

1. Make out the following bill:—

4½ dozen atlases at 12s. 6d. each.
30 dozen copy-books at 6s. per dozen.
8½ dozen copy-books at 3s. 6d. per dozen.
32 grammars at 3s. 6d. each.
12 dozen exercise-books at 2¾d. each.
25 engravings at 7s. 6d. each.
28 books binding at 4s. 9d. each.

		s.	d.		£	s.	d.
4½ dozen	at	12	6	each	33	15	0
30 ,,	,,	6	0	per doz. ...	9	0	0
8½ ,,	,,	3	6	,, ...	1	9	9
32 grammars	,,	3	6	each	5	12	0
12 doz. ,,	,,	0	2¾	,, ...	1	13	0
25 engravings	,,	7	6	,, ...	9	7	6
28 books	,,	4	9	,, ...	6	13	0
					67	10	3. Ans.

2. Find the cost of six thousand three hundred and eighty-two articles at £40 17s. 7¾d. each.

		£	s.	d.
Value of 6382 at £1 each	=	6382	0	0
				40
,, ,, £40	=	255,280	0	0
,, ,, 10s. = ½ val. at £1	=	3,191	0	0
,, ,, 5s. = ½ ,, 10s.	=	1,595	10	0
,, ,, 2s. 6d. = ½ ,, 5s.	=	797	15	0
,, ,, 1½d. = 1/160 ,, 2s. 6d.	=	39	17	9
,, ,, ¼d. = ½ ,, 1½d.	=	6	12	11½
,, ,, £40 17s. 7¾d.	=	260,910	15	8¼. Ans.

3. What is the value of 500 acres 3 roods 29 poles of land at one hundred guineas seventeen shillings and eightpence per acre?

100 guineas 17s. 8d. = £105 17s. 8d.

		£	s.	d.
Value of 1 ac.	=	105	17	8
				500
,, 500 ac.	=	52,941	13	4
,, 2 ro. = ¼ val. of 1 ac.	=	52	18	10
,, 1 ,, = ½ ,, 2 ro	=	26	9	5
,, 20 po. = ⅓ ,, 1 ,,	=	13	4	8½
,, 8 ,, = ⅕ ,, 1 ,,	=	5	5	10½ 2/5
,, 1 ,, = ⅛ ,, 8 po.	=	0	13	2⅝ 1/10
,, 500 ac. 3 ro. 29 po.	=	53,040	5	4⅞ 7/10 far. Ans.

4. Divide £9 11s. 8d. among ten men, six women, and fourteen children, giving a woman three times as much as a child, and a man twice as much as a woman.

14 children get 1 share each = 14 shares.
6 women ,, 3 shares ,, = 18 ,,
10 men ,, 6 ,, ,, = 60 ,,
Total ... ... 92 shares.

£9 11s. 8d. ÷ 92 = 191s. 8d. / 92 = 2s. 1d. child's share. Ans.
∴ a woman gets 2s. 1d. × 3 = 6s. 3d. woman's ,, Ans.
and a man ,, 6s. 3d. × 2 = 12s. 6d. man's ,, Ans.

Grammar.

1. 'The wild birds told their warbling tale,
And wakened every flower that blows,
And peeped forth the violet pale,
And spread her breath the mountain rose.'

(*a*) Show which are the nouns in the nominative case in the above, and to what verb each is the nominative.
(*b*) Point out all the adjectives in the above, and show what noun each adjective qualifies.

(*a*) The nouns in the nominative case are '*birds*' nom. to '*told*' and '*wak ned*'; '*violet*' nom. to '*peeped*'; and '*rose*' nom. to '*spread*.'
(*b*) The adjectives are '*wild*' qual. '*birds*'; '*warbling*' qual. '*tale*'; '*every*' dist. '*flower*'; '*pale*' qual. '*violet*'; and '*mountain*' qual. '*rose*.'
'*Their*' and '*her*' are pronom. poss. adjectives, and '*the*' is often reckoned a distinguishing adjective.

2. In what mood is the verb after the auxiliaries *can, must, will, shall?* Give examples.

The mood after *can, must, will, shall* is the infinitive; as, '*I can (to) go*'; '*I must (to) read*'; '*he will (to) write*'; '*they shall (to) obey.*'

Geography.

Answer two Questions.

1. Describe minutely the counties of Durham, Caithness, Pembroke, and Kerry.

Durham is a maritime county of England, bounded on the N. by the Tyne and the Derwent, which separate it from Northumberland; on the W. by Cumberland and Westmoreland; on the S. by the Tees, separating it from Yorkshire; and on the E. by the North Sea. The surface is hilly, and slopes from the west towards the coast. The principal rivers are the Wear, Tyne, and Tees. Durham is one of the chief coal and lead counties in England. Iron, and other mineral products are obtained on an important scale. A belt of agricultural land extends along the coast, in the southern part of which salt-mines are found. Iron ship-building is extensively carried on at Sunderland, South Shields, Stockton, and Hartlepool. Various manufactures are carried on, but none to any great extent.

Caithness forms the north-eastern extremity of Britain, having but one land boundary, that on the west, where a ridge of hills running north from Morven and the Ord of Caithness separate it from Sutherland. The greater part of the county is made up of mountainous moorland, surrounded by rugged cliffs. The bleak moors and marshes of the interior are being cultivated by the industry of the people, and now form one of the most fruitful districts in the north of Scotland. There are numerous lakes, and rivers valuable for salmon fishing. The glens and hollows between the mountains afford excellent pasture for cattle and sheep.

Pembroke has but one land boundary, that on the N.E., towards Cardigan and Carmarthen: on all other sides it is surrounded by the sea, and has its shores worn into deep bays and creeks, such as Bride's Bay, and Milford Haven, a harbour large enough to contain the whole of the British fleet. The county forms a peninsula at the south-west corner of Wales. Its scenery is not very rugged, and throughout the whole shire, as the hills near the sea, they sink so low that large tracts of land can be cultivated. The chief towns lie round the inlet of Milford Haven, to which population is drawn by its shipping trade and its ship-building yards.

Kerry lies next to Limerick, on the estuary of the Shannon, and projecting into the Atlantic, forms the most south-western part of Ireland. To the south and east it is bounded by the county of Cork. Its coast is more rugged than any other part of the Irish shores, and is thickly studded with small islands, of which the principal is Valentia. Two peninsulas jut out to the ocean on its western side, between the deep bays worn by the Atlantic waves, the one ending in Mt. Brandon between Bays Tralee and Dingle, and the other formed of the mass of the McGillicuddy's Reeks, between Dingle Bay and Kenmare Bay. The Reeks end on their eastern side in the mountains and lakes of Killarney, well-known for their beautiful scenery. The industry of the county is small, and consists wholly of cattle-grazing, so that it has scarcely any towns, except the fishing-town of Tralee, and Killarney, which depends on the tourists who visit the Lakes.

2. Name the rivers which water the Midland and Eastern Counties of England, and describe their course.

The rivers which water the Midland and Eastern counties are:—

(1) The *Trent*, which rises in the N. of Staffordshire, flows S.E. through Staffordshire, E. through the S. part of Derby, N.E. through Nottingham, N. through Lincoln, and unites with the Yorkshire Ouse in forming the Humber Mouth. It receives the *Sow* from Stafford, the *Derwent* from the N. of Derbyshire, and the *Soar* from Leicester.

(2) The *Great Ouse*, which rises in the S. of Northamptonshire, flows N.E. through Buckingham, Bedford, Huntingdon, and Cambridge, N. through Norfolk, and falls into the wash at Lynn Regis; it receives the *Cam* from Cambridge, and the *Little Ouse* from Norfolk.

(3) The *Witham*, in Lincoln, flows eastwards by a circuitous route into the Wash.

(4) The *Welland*, forming the northern boundary of Northamptonshire, flows eastward into the Wash.

(5) The *Nen*, flowing northwards into the Wash.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Inexhaustible.*

Write, in small hand, as a specimen of copy-setting, *One gladdening beam of cheerful light.*

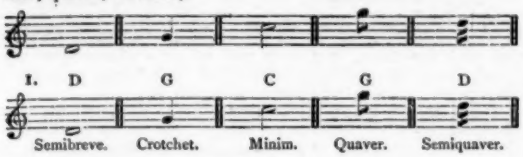
Needlework.

One hour allowed for this Exercise.

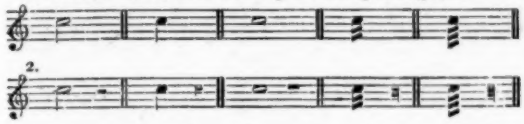
Music.

A quarter of an hour allowed for this Paper.

1. Write over each of the following notes its pitch name (C, D, *Do*, *Re*, or other), and under each its duration name (crotchet, quaver, or other).



2. Follow each of these notes by its corresponding rest.



3. Supposing we make one beat while we sing a crotchet, how many shall we make while we sing a semibreve?

3. If we make *one* beat while we sing a crotchet, we must make *four* while we sing a semibreve—a semibreve being equal to four crotchets.

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. Take from $1056\frac{3}{8}$ the sum of following numbers: $84\frac{1}{4}$, $56\frac{5}{176}$, and $195\frac{3}{8}$, and add $278\frac{3}{4}$ to the result. (Be careful not to use unnecessary figures.)

$$\{1056\tfrac{3}{8} - (84\tfrac{1}{4} + 56\tfrac{5}{176} + 195\tfrac{3}{8})\} + 278\tfrac{3}{4} =$$
$$\{1056\tfrac{3}{8} - 335\tfrac{11}{176}\} + 278\tfrac{3}{4} =$$
$$720\tfrac{1}{4} + 278\tfrac{3}{4} = 999\tfrac{2}{4} = 999\tfrac{1}{2}. \text{ Ans.}$$

2. Find the difference between $19\frac{5}{8} \times \frac{3}{16}$; and $2\frac{1}{8} \times 3\frac{1}{19}$.

$$2\tfrac{1}{8} \times 3\tfrac{1}{19} = \frac{17 \times 72}{8 \times 19} = 1\tfrac{153}{152} = 8\tfrac{1}{152}$$
$$19\tfrac{5}{8} \times \tfrac{3}{16} = \frac{157 \times 3}{8 \times 16} = 3\tfrac{111}{128} = 3\tfrac{87}{128}$$
$$\text{The difference is } 4\tfrac{207}{19456}. \text{ Ans.}$$

3. Express the height of a mountain 4 miles 7 furlongs high as a fraction of the earth's diameter, which is 7,926 miles.

$$\frac{4 \text{ mls. } 7 \text{ fur.}}{7{,}926 \text{ mls.}} = \frac{39}{63408} = \frac{3}{5072}. \text{ Ans.}$$

4. A French metre equals 39·371 English inches. Express in terms of a metre 3 miles 7 furlongs 12 poles; 5 miles 1250 yards; 17 miles 3 furlongs 2 yards 15 inches; and 7·2854 furlongs.

(*a*) $\frac{3 \text{ mls. } 7 \text{ fur } 12 \text{ po.}}{39{\cdot}371 \text{ in.}} = \frac{247896 \text{ in.}}{39{\cdot}371} = 6296{\cdot}4$ metres.

(*b*) $\frac{5 \text{ mls. } 1250 \text{ yds.}}{39{\cdot}371 \text{ in.}} = \frac{361800 \text{ in.}}{39{\cdot}371} = 9109{\cdot}5$,,

(*c*) $\frac{17 \text{ mls. } 3 \text{ fur. } 2 \text{ yds. } 15 \text{ in.}}{39{\cdot}371} = \frac{1100967 \text{ in.}}{39{\cdot}371} = 27963{\cdot}9$ mets.

(*d*) $\frac{7{\cdot}2854 \text{ fur.}}{39{\cdot}371 \text{ in.}} = \frac{57700{\cdot}368 \text{ in.}}{39{\cdot}371} = 1465{\cdot}5$ metres.

FEMALES.

1. A bankrupt fails to the amount of £2,500; what are his effects worth if he pays 7s. 9d. in the pound? And how much will one of his creditors lose to whom he owes £600 12s. 6d.?

(*a*) His effects = £2500 at 7s. 9d. each.

	£	s.	d.
£2500 @ £1 each ... ... =	2500	0	0
,, @ 5s. ,, = $\frac{1}{4}$ at £1 =	625	0	0
,, @ 2s. 6d. ,, = $\frac{1}{8}$ at 5s. =	312	10	0
,, @ 3d. ,, = $\frac{1}{10}$ at 2s. 6d. =	31	5	0
∴ his effects =	968	15	0 Ans.

(*b*) Loss per £ to each creditor = 12s. 3d.

	£	s.	d.
Loss on £600 12s. 6d. at £1 per £ ... =	600	12	6
,, ,, ,, 10s. ,, = $\frac{1}{2}$ at £1 =	300	6	3
,, ,, ,, 2s. ,, = $\frac{1}{5}$ at 10s. =	60	1	3
,, ,, ,, 3d. ,, = $\frac{1}{8}$ at 2s. =	7	10	$1\frac{1}{2}$
Total loss =	367	17	$7\frac{1}{2}$ Ans.

2. A besieged town, containing 5,000 people, has provisions for thirty days, at the rate of 12 ozs. for each person per day. Suppose a quarter of the population leave the town, and each person left is allowed 15 ozs. per day, determine the time the provisions will now last.

$$\left.\begin{matrix} 15 \text{ ozs.} : 12 \text{ ozs.} \\ 3 : 4 \end{matrix}\right\} :: 30 \text{ days} : \text{time required.}$$
$$\frac{30 \text{ days} \times 12 \times 4}{15 \times 3} = 32 \text{ days. Ans.}$$

3. If three boxes of oranges, each containing 2,060, cost £5 19s. 6d., what will seventeen boxes cost, each containing half as many again as the former?

$$\left.\begin{matrix} 3 \text{ boxes} : 17 \text{ boxes} \\ 2 \text{ oranges} : 3 \text{ oranges} \end{matrix}\right\} :: £5\ 19\text{s. } 6\text{d.} : \text{Cost}$$
$$\frac{£5\ 19\text{s } 6\text{d.} \times 17 \times 3}{3 \times 2} = \frac{£101\ 11\text{s. } 6\text{d.}}{2} = £50\ 15\text{s. } 9\text{d. Ans.}$$

Note.—The ratio of oranges in each box = 2 : 3.

4. What is the purchase money of 4 hhds. of sugar, each weighing 2 cwt. 3 qrs. 17 lbs., if 3 qrs. 16 lbs. cost £1 13s. 4d.?

3 qrs. 16 lbs. : 2 cwt. 3 qrs. 17 lbs. × 4 :: £1 13s. 4d. : ?
or or
100 lbs. 1300 lbs.
$$\frac{£1\ 13\text{s. } 4\text{d.} \times 1300}{100} = £21\ 13\text{s. } 4\text{d. Ans.}$$

Grammar.

1. 'Flow softly down by lawn and lea,
A rivulet, then a river;
No where by thee my steps shall be
For ever and for ever.'—TENNYSON.

Parse all the adverbs and pronouns in the above.

softly, adv. of manner, mod. '*flow*.'
down, ,, place, ,, ,,
then, ,, time ,, (*flowing?*)
no where, ,, place ,, '*shall be*.'
thee, pers. pron., 2nd pers., sing., standing for 'rivulet' personified, object, gov. by '*by*.'
my, pronoun, poss. adj. or poss. case of 1st pers. pron. attributive to '*steps*.'
for ever, adv. phrase of time mod. '*shall be*.'

2. Distinguish between simple prepositions, compound prepositions, and phrase prepositions, and give one or two examples of each.

Simple prepositions consist of a *single word*, as, *in*, *to*, *of*, *for*; *compound prepositions* are compounded of one another, as, *in-to*, *up-on*, *with-out*, *through-out*, *with-in*; and *phrase prepositions* are phrases of two or more words, having together the exact force of a preposition, as '*in the midst of*,' '*right through*,' '*at the moment of*,' '*in place of*.'

3. The word 'what' is used sometimes as a relative, sometimes as a direct interrogative, sometimes as an indirect interrogative pronoun. Give examples of each use.

(*a*) '*What*' is a relative, as '*I understand what you say.*'
(*b*) '*What*' is a direct interrogative, as '*What do you say?*'
(*c*) '*What*' is an indirect interrogative pronoun, as '*Tell me what he said.*'

In (*a*) the antecedent to 'what' is suppressed, 'what' introducing a subordinate adjective sentence. In (*c*) the dependent clause is a *substantive* clause having no antecedent expressed or understood to which it relates. It is based upon the direct question, '*What did he say?*'

Geography.

Answer either No. 2 or No. 3, not both.

1. Draw a full map of Italy, with the adjacent islands. Insert the lines of latitude and longitude.

2. Give notes of a lesson on 'The Rivers of Russia flowing southward,' and show how the nature of the country affects their courses.

I. Sketch on blackboard the outline of Russia showing the Valdai Hills. Explain water-shed to be the line or division separating one river-system or basin from another—sometimes very well defined as the Alps, dividing the rivers of Northern Italy from those of Switzerland—but in Russia on account of the general flatness of the country the watershed is not formed by mountains, but by tracts of gently-rising ground. Taking the knuckle of land a little to the West of Moscow we have three lines of watershed—*one* running from the Moskwa N. E. to the Urals, separating the rivers which flow into the Caspian from those which flow into the White Sea, and containing the sources of the Volga and other large rivers. *Another* beginning near the same point extends S. E., dividing the Volga from the rivers which run southward and unite with the Dnieper and the Don. The *third* extends westward to the Bug, and forms an almost continuous swamp, in which many affluents of the Vistula, Dnieper, and Don take their rise. As Russia is essentially a level country, the rivers present a greater line of inland navigation than those of most other countries.

II. Sketch the courses of (1) the Volga (with its tributaries the Oka and Kama), flowing into the Caspian Sea; (2) the Don into the Sea of Azov; (3) The Dnieper, (4) the Dniester, and (5) the Bug, flowing into the Black Sea.

3. Write a letter as from an Englishman in Spain, describing what he had seen in that country that was new to him, and unlike anything in England.

Madrid, July 29, 1882.

SIR,—Having reached the capital of Spain, after a general survey of the country and its people, I shall give you a few of those peculiarities which I considered most striking.

There is no country of Europe except Switzerland which possesses such an extent of mountainous surface as Spain. The Pyrenees, like a huge rampart, stretch along the northern border so unbroken that there are only two passes that allow the passage of wheeled vehicles. There are many shallower passes, seemingly cut in the rocks, only fit for mules and foot-travellers. Four other chains run parallel to the Pyrenees, called Sierras, from the *saw-like* appearance of their summits.

The interior of the country consists of a series of plateaux or terraces, separated by these lofty sierras, the higher peaks of which are covered with snow. On the borders, however, Spain resembles many countries of Europe, for the exposure of its north coast to the Bay of Biscay gives it an English character, while the southern end partakes of an African character; and here the produce consists of date-palms, bananas, and sugar-canes. The central parts favour the growth of the vine. Although the country is not famed for large quantities of timber, the mountain-sides are in some districts clothed with trees, notably, the *cork-oak*, which produces the thick bark, that constitutes the cork of commerce. The roads of the country are so bad that in the south crops of wheat have been utterly wasted for want of good carriage-way to transport them to the sea.

Among its animals, mention must be made of the *merino* sheep, whose fleece is so fine and highly prized, and the Andalusian bull, in demand for the bull-fights which form the national sport, corresponding to horse-racing in England. Mules and asses are very much finer than any seen in England and are as commonly used as horses are in our country.

The tunny, a fish caught for its oil and for food; the sardine, which goes to England preserved in oil; and the anchovy are fished in the Mediterranean.

Millions of hives store the honey gathered from the flowers of every part of the country. Silkworms are reared for their cocoons, and the cochineal insect for its dye.

The bear, wolf, lynx, and wild boar are found in various retired parts, and a species of monkey is seen at Gibraltar.

At Almaden is one of the richest quicksilver mines in the world, and in Galicia is found a supply of cobalt almost equal to the demand of all Europe, and exhaustless mines of rock-salt are met with in Catalonia.

Wine is the great national manufacture, of which Xeres is the centre, and gives name to the principal export, *sherry*.

The country, as was said above, is badly off for roads, which prevents the progress of inland traffic, but the introduction and spread of the railway system will reduce this evil.

A traveller, new from the verdure of England, is astonished and horrified at the treeless aspect of the country. The Spaniards seem to have an innate hatred to trees, and if they do not cut them for firewood, they cut them down because they afford a harbour for sparrows that eat the grain.

The finest people of Spain are found in Andalusia, who are tall and handsome, and look well in their picturesque costume when they congregate to show off their finery, and smoke their paper cigars in the squares of the towns.

I should have noted that agriculture is everywhere in a very backward state, the implements being of the rudest description. Of the noxious winds that exceed even the most rigorous of English east winds, are the *Solano*, a hot wind from the south, and the *Gallego*, a cold, piercing one from the N.W.

I am, Sir,
Your obedient servant,
PUPIL TEACHER.

To ——— Esq.
H. M. Inspector of Schools.

History.

1. Give the names and dates of our sovereigns from Egbert to Edward the Elder.

	A.D.
Egbert became King of England	827
Ethelwolf ,, ,,	836
Ethelbald ,, ,,	858
Ethelbert ,, ,,	858
Ethelred ,, ,,	866
Alfred ,, ,,	871
Edward the Elder ,, ,,	901

2. What sovereigns ascended the throne in 1135, 1377, 1422, and 1509? Name their immediate successors.

Stephen ascended the throne 1135; was succeeded by Henry II.
Richard II. ,, ,, 1377; ,, ,, Henry IV.
Henry VI. ,, ,, 1422; ,, ,, Edward IV.
Henry VIII. ,, ,, 1509; ,, ,, Edward VI.

3. Write down a list of our sovereigns from 1685 to 1760.

James II.	began to reign	1685 (deposed 1688)
William III. and Mary II.	,,	1689
Anne	,,	1702
George I.	,,	1714
George II.	,,	1727
George III.	,,	1760

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Inexhaustible*.

Write, in small hand, as a specimen of copy-setting, *One gladdening beam of cheerful light.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Music.

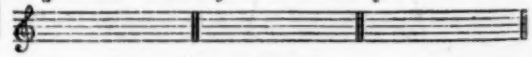
A quarter of an hour allowed for this Paper.

1. What is meant by *sound*, what by a *tone*; and how does a sound differ from a tone?

1. *Sound* is the effect on the ear of the vibration of the air caused by some disturbing force. When the vibration is regular, the result is a *musical* sound.

A *tone* is the interval between two sounds, either higher or lower, and can be divided into two semitones.

2. What is a *triad*? Write in *a*, *b*, and *c* severally the triads of (F) *Fa*, (B♭) *Se*, and (C) *Do*.



2. A *triad* is the addition of its *third* and *fifth* to any given note.

3. How many tones and how many semitones are found in the diatonic major scale, and what are the places in it of the latter?

3. Five tones and two semitones, the latter being found between the third and fourth, and seventh and eighth notes.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. How much stock, at 91⅛, can be bought for £768; the broker's commission being ⅛ per cent.?

£91⅛ + ⅛ : £768 :: £100 : stock

$$£\frac{100 \times 768 \times 4}{365} = £\frac{81\,4\,8}{73} = \underline{£841\ 12^{s}.\ 7\tfrac{7}{73}d.}\quad \text{Ans.}$$

2. In 1831, the population of England and Wales was 13,896,797; in 1841, it was 15,914,148; in 1851, it was 17,927,609; in 1861, 20,066,224; and in 1871, 22,782,266. What was the ratio of increase per cent. during each interval of ten years?

Increase per cent. from 1831 till 1841 $= \frac{2017351 \times 100}{13896797} = \underline{14{\cdot}51}$

" " " " 1841 " 1851 $= \frac{2013461 \times 100}{15914148} = \underline{12{\cdot}65}$

" " " " 1851 " 1861 $= \frac{2138615 \times 100}{17927609} = \underline{11{\cdot}93}$

" " " " 1861 " 1871 $= \frac{2716042 \times 100}{20066224} = \underline{13{\cdot}53}$

3. If a grocer mixes 17 lbs. of tea worth 4s per lb., with 25 lbs. worth 4s. 8d. per lb., and sells the whole at 5s. 4d. per lb., what is his total gain, and what is his profit per cent.?

		s.	d.	s.	d.
(*a*)	17 lbs. at	4	0 =	68	0
	25 " "	4	8 =	116	4
	Cost price		=	184	4
	42 lbs. at	5	4 =	224	0
	Total gain		=	40	8 = £2 0s. 8d.

(*b*) 184½ : 40⅔ :: 100 : gain per cent.

$$\frac{100 \times 122}{553} = \underline{22\tfrac{4\,4}{5\,5\,3}}.\quad \text{Ans.}$$

4. What sum put out at simple interest, at 4¾ per cent., will amount to £1310 14s. in six years?

Amount of £100 for 6 years at 4¾ per cent. = £128½

∴ £128½ : £100 :: £1310 14s. : sum required

$$\frac{£1310\ 14s. \times 100 \times 2}{257} = \underline{£1020.}\quad \text{Ans.}$$

FEMALES.

1. Simplify:—

(*a*) 17⅞ + ⅛ of 7⅛.

(*b*) ½ + ⅔ + $\frac{7}{11}$ + $\frac{7}{13}$ + $\frac{1}{15}$.

(*a*) 17⅞ + ⅛ of 7⅛ = 17⅞ + $\frac{4 \times 47}{5 \times 6}$ = 17$\frac{1\,5}{4\,0}$ + 6$\frac{1\,9}{4\,0}$ = $\underline{23\frac{1\,4}{4\,0}}$. Ans.

(*b*) ½ + ⅔ + $\frac{7}{11}$ + $\frac{7}{13}$ + $\frac{1}{15}$ = $\frac{99 + 44 + 54 + 77 + 102}{198}$

= $\frac{3\,7\,6}{1\,9\,8}$ = $1\frac{9\,0}{9\,9}$

2. If 30 horses eat 25½ bushels of oats in 6 days, how much will one horse eat in a week?

30 horses : 1 horse
6 days : 7 days
:: 25½ bushels : ?

$$\frac{180 \text{ bushels} \times 1 \times 7}{7 \times 30 \times 6} = \underline{1 \text{ bushel.}}\quad \text{Ans.}$$

3. A man, after spending ⅓ of his money, and then ¼ of the remainder, and then ⅕ of what then remained, had £25 left; how much had he at first?

Otherwise ⅔ of ¾ of ⅘ of the whole money = £25

that is $\frac{3 \times 2 \times 1}{4 \times 3 \times 2}$ " " = £25

" ⅕ " " = £25

∴ the whole money = £100. Ans.

4. Divide £120 7s. 10½d. by 8⅞, and multiply the result by 4⅔.

£	s.	d.		£	s.	d.	
120	7	10½					
		9					
79)1083	10	8½ (		13	14	3⅞	Quotient
79						4⅔	
293			9)109	14	6		
237				12	3	10	
56				54	17	3	
20				67	1	1	Ans.
1130							
79							
340							
316							
24							
12							
296							
237							
59							
4							
237							
237							

Grammar.

1. What conjunctions are used in asking indirect questions, and what mood is generally used after such conjunctions? Illustrate your answer by examples.

The conjunctions used in asking indirect questions are *whether, if, unless, although, except*; as, '*Do you know whether he will come?*' '*Inform me if you can.*' '*Except he confess I shall not pardon him.*'

2. 'Take warning! he that will not sing
While yon sun prospers in the blue,
Shall sing for want, ere leaves are new,
Caught in the frozen palms of spring.'—TENNYSON.

(*a*) Analyse the above passage from '*Take warning!*' . . to . . '*want.*'

(*b*) Give the meaning in plain simple words of your own.

(*c*) Parse all the verbs in the above.

(*a*)

Sentence.	Kind.	Subject.	Predicate.	Object.	Extensions.
(1) Take warning	Principal	(*thou*)	take	warning	—
(2) he shall sing for want	Principal	he	shall sing	—	for want (*reason*)
(3) that will not sing	adjective to (2)	that	will not sing	—	—
(4) while yon sun prospers in the blue.	adverbial to (3) (*time*)	(while) yon sun	prospers	—	in the blue (*place*)

(*b*) I advise you to make the most of the sunny time of summer, and sing to me in order that you may not feel the sharp edge of hunger before the buds open, and before you are driven to despair by the cold frosty days of early spring.

(*c*) *Take*—irreg. trans. verb, *take, took, taken*, imper. 2nd pers. sing. agr. with (*thou*).

will sing—irreg. intrans. verb, *sing, sang, sung*, indic. future indef. 3rd pers. sing. agr. with '*he.*'

prospers—reg. intrans. verb, indic. pres. indef. 3rd pers. sing. agr. with '*sun.*'

shall—irreg. defec. verb, *shall, should*, indic. pres. indef. 3rd pers. sing. agr. with '*he.*'
sing—irreg. intrans. verb, *sing, sang, sung*, infin. pres. indef., gov. by '*shall.*'
are—irreg. intrans. verb, *am, was, been*, indic. pres. indef., 3rd pers. plur. agr. with '*leaves.*'
caught—irreg. trans. verb, *catch, caught, caught*, complete part. attrib. to '*he.*'

Geography.

Answer No. 2 or No. 3; not both.

1. Give notes of a lesson on 'The British Settlements in Australia,' and illustrate it by sketch-maps, showing the position of each settlement. Insert the lines of latitude and longitude.

NOTES OF LESSON ON AUSTRALIA.

(*a*) *Position.*—Between 10° 40′ and 39° 12′ S. lat., and between 113° and 153° 39′ E. long. *Shape.*—Trapezoidal or of an irregular onion form. *Size*, 2500 miles from E. to W. 1970 miles from N. to S.; area about 3,000,000 square miles, or ¼ less than Europe.

(*b*) British settlements and chief towns:—

New South Wales, .	Sydney, Newcastle, Bathurst.
Victoria, . . .	Melbourne. Geelong, Ballarat.
S. Australia, . .	Adelaide, Kooringa.
W. Australia, . .	Perth, Freemantle.
Queensland, . .	Brisbane, Ipswich, Rockhampton.

(*c*) *New South Wales*—so named by Cook—founded 1788—a penal settlement at first—ceased to be such in 1840—new life given to colony after discovery of gold 1851. *Victoria*—settled 1835—first called Australia Felix—colonists came from Tasmania—discovery of gold caused a great influx of adventurers—soon became the foremost of Australian colonies. *S. Australia*—proclaimed a colony 1839—suffered much from over speculation—assisted by Home Government—discovery of copper mines at Burra-Burra hastened its prosperity. *W. Australia*—settled 1829—first called Swan River Settlement—from various causes has not been so prosperous as the other colonies. *Queensland*—proclaimed a colony 1859—formerly part of New South Wales, and called Moreton Bay Settlement.

(*d*) The mountain ranges of Australia are all on or near the coast, and this fact combined with the impassable character of these chains, and the uninviting nature of the interior, caused the settlements to be founded along the sea-board, where there are many rivers and general fertility.

(*e*) Its seasons the reverse of ours—being nearer the equator than Great Britain, its temperature is much higher—monsoons blow in the northern half—westerly winds prevail in south—speaking generally the settled districts are dry and healthy—in New South Wales, Victoria, and S. Australia, these three peculiarities may be noted: (1) *long droughts*, very destructive; (2) hot *winds*, blowing from the interior; (3) sudden transition from heat to cold. *Productions.*—Gold, copper, wool, tallow—land better suited for pasture than tillage—vegetation goes on all the year, and is peculiar, consisting chiefly of gum trees, acacias, and heaths—food plants of Europe have been introduced—native animals nearly all pouched (*e.g.* Kangaroo)—remarkable birds are lyre-bird, emu, and black swan.

2. Trace the course of a ship from London to Bombay by the Suez Canal, describing minutely each British dependency you pass.

Leaving London, the metropolis of the British Empire, we sail eastwards to the mouth of the Thames, turn southwards through the Strait of Dover and the Downs, and enter the English Channel. Off the coast of France, and geographically connected with it, lie the Channel Islands, the oldest foreign possession of the British Crown, being all that is now left of the territory brought by William I. They consist of Jersey, Guernsey, Alderney, and Sark, but as they are more a part of Britain than a dependency they need not be described here. Proceeding down through the Bay of Biscay, and passing the coast of Portugal and Spain, we turn eastward to Gibraltar, the 'Key of the Mediterranean.' Gibraltar Rock is a mass of gray stone about three miles long, from north to south, and nearly a mile broad. It is connected with the mainland by an isthmus, and ends in the south in Europa Point. The rock rises more than a 1000 ft. in some places, is inaccessible on the north and east, and nearly so on the south. On the west where it slopes down to Gibraltar Bay it is protected by batteries, and the whole is so defended that it is considered impregnable. The town of Gibraltar fronts the Bay on the north-west; Gibraltar has belonged to Britain since 1704. Proceeding on our voyage we continue east till we arrive at Malta and the adjacent islands of Comino and Gozo. Gozo, the most northerly of the three has a rich soil and a famous Giant Tower. Comino is a small island between the two. Malta, the largest and most important is half the size of the Isle of Wight, with a mild and healthy climate. It produces cotton, grain, and fruits. The group has a population of 152,000. Valetta, the capital, is strongly fortified, and a central station for British ships. Our route still continues east to Alexandria and Port Said, where we enter the Suez Canal, which is so important to Britain as a short passage to India, that she has gone to war to protect it. Passing down the canal we reach Suez and enter the Red Sea, leaving which by the Straits of Babelmandeb we arrive at Aden, situated at the south-west corner of Arabia, about 100 miles from the entrance to the Red Sea. This place is used as a depot for the supply of coal to the steamers running on such a voyage as this. It is also an important military station, being near the entrance to the Red Sea. In the middle of the Strait of Babelmandeb is the island of Perim, which was occupied by the British for the purpose of building a light-house upon it. Proceeding across the Arabian Sea, we arrive at our destination, Bombay.

3. Write a letter as from an Englishman in Spain, describing the things he has seen in that country that were new to him and unlike anything in England.

(See this question answered under First Year).

SECOND PAPER.

Two hours and a half allowed.

History.

1. What roads did the Romans make in Britain? With what object, and with what effect on the country?

Four great roads crossed the country between distant and important points: these were *Watling Street*, from Rutupiæ (Richborough) in Kent by London to Carnarvon; *Ikenild Street*, from Tynemouth by York, and through the Midlands to St. David's; *Irmin Street*, from St. David's to Southampton; and the *Foss*, from Cornwall through Exeter to Lincoln. These were great military roads, which enabled the Romans to strike at any insurrection of the people, as well as protect the island from aggressors. By their means, too, they opened up the island and developed the resources.

2. Give the date and circumstances of the death of William I. Who succeeded to his dominions? Was it for the interest of the nobles and the people of this country that they should be divided or kept under one ruler?

The French king having insulted William, the latter declared war, and during the siege of Mantes, the English king rode out to view the burning town. The plunging of his horse, which trod on some hot embers, bruised him severely against the pommel of the saddle. The bruise inflamed, and after six weeks he died at Rouen (1087).

His son William succeeded him, and it was to the interest of the nobles and people to be united under one ruler, for under two rulers the country would never be at rest. The union of the nobles and the people prevented the tyrannous kings from invading the privileges of either. If the nobles had chosen Robert, and the people William, the nobles would have fared badly as they were very much in the minority, and unable to cope with the common people.

3. Who was Henry III.? At what date did he ascend the throne, and what event of first importance to the liberties of the people happened in his reign?

Henry III., son of King John, ascended the throne 1216, when only ten years of age.

In his reign, 1265, the Earl of Leicester called a parliament, to which he summoned representatives from cities and boroughs, in addition to the prelates, barons, and knights of the shire. This was the first outline of our modern Parliament; the prelates and barons corresponding to the House of Lords, the others to the House of Commons, which, accordingly, dates from this time.

Composition.

Write full notes of a lesson on *The Army*.

Introduction.—If drill is taught, begin by asking the use of it—draw from the children what they have heard about volunteers—militiamen—regular soldiers—describe, or get from children the meaning of uniform—why so called—some of them may have relations among the volunteers—or among the militia—or *in the army*.

THE ARMY.—Difference between the army and the volunteers—how the men are enlisted—Queen's shilling—recruit—swearing in—feelings of the new soldier—parting from home, etc.—*barracks* described—life of the soldier—care taken of him—school in the barracks—books for reading—savings from wages put in bank—sleeping rooms described—soldier makes his own bed—cleans his arms—what are his arms?—parade—examination by the officer—punishments—the march out—the band—and the drummer-boys—anecdotes or stories about drummer-boy.

PARTS OF THE ARMY.—*Infantry*—squad—company—battalion—regiment—brigade—division. *Cavalry*—troop—squadron. *Artillery.*—*Engineers.*—the duties of these.

RANKS IN THE ARMY.—Private—corporal—sergeant—lieutenant—captain—major—colonel—general—field-marshal—ask for names of celebrated soldiers.

USE OF THE ARMY.—Protection at home and abroad—keep out enemies and defend our foreign possessions—explain garrison duty—foreign stations—foreign service. Refer to the war in Egypt, and give some account of the transport of the troops—and explain why the war is undertaken—the use of the Suez Canal for the short passage of soldiers to India in case of war there. Ask names of celebrated battles.

N.B.—*The difficult and novel words in the above lesson to be carefully written on black-board, and copied by the children for spelling and meaning.*

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Inexhaustible.*

Write, in small hand, as a specimen of copy-setting, *One gladdening beam of cheerful light.*

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. From a given point, to draw a straight line equal to a given straight line.

Prop. 2, Bk. I.

2. The middle point of the base of an isosceles triangle is joined to the vertex; show that the triangles so formed are equal in all respects. (Apply proposition 5, then 4).

Because ABC is isosceles, by prop. 5 the angles at B and C are equal; and by hypothesis BD = DC, and AB = AC. ∴ By prop. 4 the triangles ABD, ACD are equal in every respect. Q. E. D.

3. If at a point in a straight line, two other straight lines, upon the opposite sides of it, make the adjacent angles together equal to two right angles; then these two straight lines shall be in one and the same straight line.

Prop. 14, Bk. I.

Needlework.

FEMALES.

One hour allowed for this Exercise.

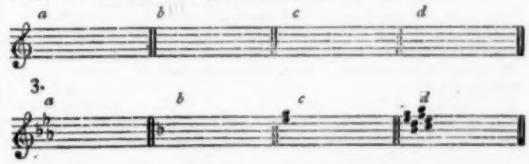
Music.

A quarter of an hour allowed for this Paper.

1. Write under each of the following intervals its name (second, third, or other) and quality (major, perfect, or other).

2. Place before *a*, *b*, and *c* their time signatures.

3. Write in *a* the scale signature of E♭ (*Mi*), in *b* that of F (*Fa*), in *c* that of G (*Sol*), and in *d* that of E (*Mi*).



THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after, 1st May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. What is the compound interest on £1150 for 2½ years at 5 per cent?

5 per cent. interest = $\frac{1}{20}$ of principal to be added for every year.
" " = $\frac{1}{40}$ " " " half year.

$\frac{1}{20}$ of	1150	0	0		
	57	10	0		
$\frac{1}{20}$ of	1207	10	0	= amt. at end of year.	
	60	7	6		
$\frac{1}{40}$ of	1267	17	6	= " "	2nd year.
	31	13	11½		
	1299	11	5½	= " "	2½ years.
deduct	1150	0	0		
	149	11	5½	= comp. int. for 2½ years.	Ans.

2. Give an easy rule for reducing English money to a decimal form up to 3 places, and say what advantage there is in working sums in interest by decimals, and what chance there is of error in employing this method. Apply your rule to the reduction of £767 14s. 6¼d. to decimals, and to the conversion of £15·468 to ordinary money.

Rule.—Take the pounds as whole numbers and fill up to three places of decimals as follows:—100 *for every* 2 *shillings*, 50 *for a shilling*, 25 *for* 6 *pence and* 1 *for every additional farthing.*

In working sums in interest by this method we have the advantage of multiplying a simple multiplication sum, whereas by keeping the denominations £ s. d. we have the laborious work of compound multiplication. As the farthing in the above rule is reckoned ·001 of £1 instead of $\frac{1}{960}$ of £1 without very serious error, yet in cases where the decimal expression has to be multiplied considerably it is better to follow the rule above

ts 'ar as sixpence; *but for every penny above an even sixpence place* 416 *in the third and following places, and for every odd farthing place* 10416 *in the third and following places as far as required.*

	(a)		(b)		
£767	= 767·000	£15	= 15	0	0
14s.	= ·700	·4	= 0	8	0
6d.	= ·025	·05	= 0	1	0
¾d.	= ·003	·018	= 0	0	4½
	767·728 Ans.		£15	9	4½ Ans.

Rule for working (*b*). *Take two shillings for every* 1 *in the first decimal place, one shilling for every* 5 *in the second and a farthing for each of the remaining figures to the third place.*

3. Reduce 2746 American dollars 30 cents. to English money, assuming the dollar to be worth 4s. 3½d. of our money in exchange.

	£	s.	d.
2746·3 @ £1 =	2746	6	0
4s. = ⅕ of £1 =	549	5	2⅖
3d. = 1/20 of 4s. =	34	6	6 1/10
½d. = ⅙ of 3d. =	5	14	5 5/12
	589	6	2 9/12 Ans.

4. If two trains meet, the one 150 yards long, moving at the rate of 50 miles an hour, and the other 240 yards long, at the rate of 40 miles an hour; how long will they be in passing one another?

The two trains pass one another with a velocity equal to the sum of their rates per hour, that is, 90 miles, and the question simplified is: *How long will it take a train going at the rate of* 90 *miles an hour to run* 390 *yds?*

90 mls. : 390 yds. :: 1 hr. : time required.

$$\frac{3600 \text{ sec.} \times 390}{90 \times 1760} = \frac{143}{44} = 8\frac{11}{44} \text{ sec. Ans.}$$

FEMALES.

1. Express as vulgar fractions in their lowest terms:—

·4, ·036, 2·05, 500·0709, and 53·0000100.

·4 = 4/10	= 2/5
·036 = 36/1000	= 9/250
2·05 = 205/100	= 2 1/20
500·0709	= 500 709/10000
53·0000100	= 53 100/1000000

2. Find the continued product of 2·03 × 203 × ·00203 × 20300. Prove the truth of the result by fractions.

(*a*)

2·03
2 03
6 09
406
412·09
·002 03
1236 27
82418
·83654 27
203 00
25096281 00
16730854
16981·81681 Ans.

Proof.

(*b*) $\frac{203}{100} \times \frac{203}{1} \times \frac{203}{10000} \times \frac{20300}{1} =$

$$\frac{203 \times 203 \times 203 \times 20300}{100 \times 10000} = \frac{1698181681}{100000}$$

$$= 16981\frac{81681}{100000}$$

3. A man who owns ⅞ of a farm sells 4/11 of his share, what decimal part of the farm does he still own?

After selling 4/11 he has 7/11 left.

$$\frac{7}{11} \text{ of } \frac{7}{8} = \frac{49}{88} = \frac{6{\cdot}125}{11} = {\cdot}55681$$

4. A tradesman having charged ·875 of a crown too much in his bill gave in change 12·4375s.; what was the amount of change he ought to have given?

Amount of proper change = 12·4375s. + ·875 of 5s.
= 12s. 5¼d. + 4s. 4⅜d.
= 16s. 9⅝d. Ans.

Grammar.

1. Analyse the following passage, and parse each word:—

'Sweet it is to have done the thing one ought
When fallen in darker days.'—TENNYSON.

Sentence.	Kind of Sentence.	Subject.	Predicate.		Object.	Extension.
(1)			Verb.	Completion		
Sweet it is to have done the thing	Principal	it	is	sweet to have done the thing		
(2) (*Which*) one ought (*to have done*)	Adjective to (1)	one	ought	(*to have done*)	(*which*)	
(3) When (*one* has) fallen in darker days.	adverbial to (1)	(when) (*one*)	has fallen			in darker days. (*time*)

Sweet—adj. predicative of it.
it—pers. pron. 3rd pers. neut, sing. nom. to '*is*.'
is—irreg. intrans. verb, *am, was, been*, indic. pres. indef., 3rd pers. sing., agr. with '*it*.'
to have done—irreg. trans. verb, *do, did, done*, gerundial infin., perfect indef., in apposition with '*it*.'
the—def. art. or dist. adj., limiting '*thing*.'
thing—com. noun, neut., sing., obj., gov. by '*to have done*.
one—indef. pron., 3rd pers. sing., com. nom. to '*ought*.'
ought—irreg. defec. verb, (originally past tense of 'owe,' now either pres. or past, according to the tense with which it is joined), indic. past indef. because joined with (*to have don*) 3rd pers. sing., agr. with '*one*.'
When—adverbial conjunction, modif. 'fallen' and introducing a subord. adverb. sent.
fallen—irreg. intrans. verb, *fall, fell, fallen*, complete part. attrib. to '*one*.'
in—prep. gov. obj. case '*days*,' which it relates to '*fallen*.'
darker—adj. compar. deg., qual. '*days*.'
days—abstr. noun, neut. plur. obj., gov. by '*in*.'

2. Make a sentence which shall contain both an enlargement of the subject and an extension of the predicate. Mark which you mean for each.

The examination *which is now proceeding* (enlarg. of subject) is being held *on the 29th day of July* (extension of predicate).

3. Paraphrase the following:—

'O son! thou hast not true humility—
The highest virtue, mother of them all.'—TENNYSON.

My child, you do not possess that lowliness of self-estimation which is the origin of all the best qualities in man. Moore has well written—

'*Humility* that low sweet root
From which all heavenly virtues shoot.'

4. What is the Latin preposition that means across? Give examples of its use in the composition of words.

The Latin preposition that means 'across' is *trans* (*tra-tres*), *trans*pose, *tra*duce, *tres*pass.

Geography.

Answer No. 2 *or No.* 3; *not both.*

1. Give notes of a lesson on the Nile; and illustrate it by a full map. Insert the lines of latitude and longitude.

Method.—Sketch on Black-board the course of the river as lesson proceeds.

SOURCE AND COURSE.—Has its chief source in the Victoria N'yanza (discovered by Baker and Speke) near the equator—runs for 3000 miles—passes through the Albert N'yanza—traverses a level region to Gondokoro—flows with many windings first N. W. then N.E., receives the Bahr-el-gazal (*sketch in*)—turns east—then south—and receives from the east, the Sóbat (*sketch in*)—strikes north—is joined by the Bahr-el-Azrek (*sketch in*)

from Abyssinia, continues north—is joined by the Atbara (*sketch*), under the name of the Takazze—winds through Nubia—enters Egypt at Assouan—at Cairo it begins to form the Delta, that is, an equilateral triangle, the corners of which are at Cairo, at Rosetta, and at Damietta.

Delta.—Surface nearly equal in area to Holland and Belgium—this vast plain produces cotton and wheat—on the banks of the canals and of the branches of the river are built towns and villages—the most important towns being Damanhour, Mansourah, Tantah, Zagazig, by the side of which passes the sweet-water canal, beginning at Ismailia, and ending at Suez. (*Speak of this in connection with present war in Egypt, and draw from the children what they may have heard or read about Egypt in the papers.*)

Use of the Nile.—Fertility of Egypt due entirely to the mud brought down by the annual inundation which begins about the end of June, continues to rise during July and August, and attains its greatest height in September—inundation due to heavy rains in the highlands of Abyssinia, and in the basin of the N'yanza—year after year this phenomenon occurs, almost within a few hours of the same time—and to within a few inches of the same height. *Nilometer*—a graduated column standing in a kind of tank, communicating with the river—employed in measuring the rise of the Nile during its periodical floods.

Towns on the Nile.—Khartoum, Senaar, Berber, New Dongola, Derr, Thebes, Ghenneh, Cairo, Damietta, Rosetta, and Alexandria. (*Remarks to be made on these, and the position of the cataracts or rapids of the river marked on the sketch.*)

2. Describe minutely a journey by land from Teheran to Calcutta.

Starting from *Teheran*, which stands in the midst of a desert plain, we join one of the caravans by which the internal trade of Persia is carried on. Crossing the sterile region which occupies almost the entire east of the country, we enter Afghanistan, and reach *Herat*. This town is of great military and commercial importance, being the centre of a great trade between India, China, Tartary, Afghanistan, and Persia. It is regarded as the key of India on the west, and has alternately belonged to Persia and Kabul. Leaving this town and continuing our journey along a good military road, we arrive at *Kabul*. This city has an extensive trade between Russia, China, Turkestan, and India, and has been the scene of, at least, two treacherous attacks on the British in 1842 and 1879. Not far off lies the town of *Jelalabad*, which we pass on our way through the Kyber Pass to *Peshawur*, which is the frontier town of Hindustan towards Afghanistan. Since its occupation by the British its trade has greatly increased. Following the route of the proposed railway from Peshawur to *Lahur*, we pass *Attock* and *Jhelam*. From Lahur (Lahore), the capital of the Panjab, we take advantage of the railway and pass Delhi, long the metropolis of the Mohammedan Empire in India, famous for the siege in 1857; *Agra*, with the famous mausoleum of Shah Jehan; *Kanhpur* (Cawnpore), one of the most commercial cities on the Ganges, will be long memorable as the scene of Nana Sahib's brutal atrocities; *Allahabad*, at the confluence of the Ganges and Jamna, a sacred city; *Benares*, one of the most sacred of Hindu cities, a very busy place; *Patna*, with a large trade; *Chandernagore*, belonging to France; *Serampoor*, and soon after we arrive at our destination, *Calcutta*, the capital of British India.

3. Trace the course of a ship from London to Bombay by the Suez Canal.

(See same question answered under Second Year.)

SECOND PAPER.

Two hours and a half allowed.

History.

1. What lines of English sovereigns came from Wales and Scotland respectively? Distinguish between their title to the throne.

From Wales came the Tudor line. The first of the line was Henry VII., who was grandson of Owen Tudor, a Welsh gentleman, and Catherine, widow of Henry V. Henry's claim to the throne was rather shaky, and though he claimed it by inheritance and by conquest, yet he had to obtain from the Pope a bull, excommunicating all who should disturb him or his heirs. For fifteen years his seat was one of much danger, for plot after plot rose to annoy him. In 1502 a marriage was arranged between James IV. of Scotland and Margaret, Henry's eldest daughter. From this marriage resulted the union of the English and Scottish Crowns in the person of James VI., by which Scotland gave a king to England in 1603. James was the first of the Stuart line on the English throne. By the death of Elizabeth, the last of the Tudor line, without heirs, James who represented the Tudor claim, became the undisputed king of the whole island. His cousin, Arabella Stuart, was made the puppet of a few schemers, but the plot was easily snuffed out.

2. When and under what circumstances did the English begin to found colonies? Of what benefit are our colonies to the people?

The reign of James I. is noteworthy for the beginning of the great colonial empire of Great Britain. In 1607 James granted a charter to a company of traders who founded a colony in the district, now called Virginia, and named its capital James Town. In 1610 Lord Delaware proceeded to the colony of Virginia, and thus were laid the foundations of the now great Republic of the United States.

The advantages of the colonies to the people are the opportunities which industrious labourers and small capitalists have of mending their condition, by emigrating to a country where labour is wanted, and where land can be had at a very small price. They furnish a new home for thousands of poor, who find it a difficult matter to gain a livelihood in their own country.

3. What rebellions has England had to encounter in America and Asia during the present reign? By what means has she removed discontent?

During the present reign, in 1857, when a mutiny of the Sepoys broke out at Meerut, in India, and for a year a horrible war raged, in which foul massacres were perpetrated by human fiends. At the end of the war, the government of India was vested in the Crown, 1858. Hitherto the East India Company had shared in the exercise of political functions, for which it was wholly unqualified. The Government of this great dependency is now conducted by a responsible minister, with the advice of a Council of State. A just, mild, and peaceful dominion has now taken the place of gross oppression, the learning of Europe has been introduced, and natives of India, men of high talent and character have been admitted to a share of power, and sit in the Viceroy's Council side by side with the ablest soldiers and civilians. The visit of the Prince of Wales a few years ago had a very beneficial effect.

In 1837 a rebellion headed by Papineau and Mackenzie, disturbed Upper and Lower Canada. This was defeated, and in the following year, during the winter, a second rising took place, but it was soon suppressed. To strengthen the government of the Colony an Act of Parliament was passed in 1840, by which the two provinces were united, and the legislative councils of the united provinces were consolidated. A modification of the Constitution took place in 1853, giving a more democratic representation to the country, but in 1867 all previous laws on the subject were repealed, which federally united into one dominion the former separate provinces of Canada, Nova Scotia, and New Brunswick. As originally intended, the Confederation was contemplated to include the whole of the British North American possessions, and such is gradually being the case.

Riel's rebellion, in 1870, was easily suppressed by Colonel (now Sir Garnet) Wolseley.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Inexhaustible.*

Write, in small hand, as a specimen of copy-setting, *One gladdening beam of cheerful light.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two Questions, including (if possible) No. 2.

1. If two triangles have two sides of the one equal to two sides of the other, each to each, but the angle contained by the two sides of the one of them greater than the angle contained by the two sides equal to them of the other; the base of that which has the greater angle shall be greater than the base of the other.

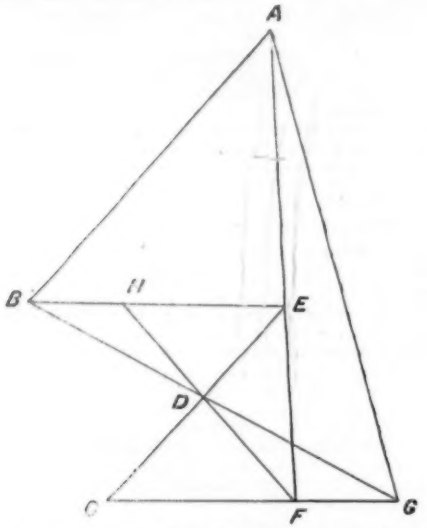
Prop. 25, Bk. I.

2. In any triangle ABC, if BE, CF be perpendiculars on any line through A, and D be the bisection of BC, show that DE = DF.

(Produce ED to meet CF in G; prove ED=DG, and then DF=ED=DG.)

Let ABC be any triangle; let AF be any line drawn through A, upon which let BE, CF be perpendiculars, join E and F with D the bisection of the base. DE shall be equal to EF.

Produce ED, CF to meet in G. Because BD=DC and the angles DBC, DCG are equal; as also BED, DGF, BE being parallel to GC, then (I. 26) the triangles BDE, DGC are equal in every respect. ∴ ED=DG.



Produce FD to meet BE in H; then since the sides ED and DG are equal, as also the angles EHD, DFG, and the angles HDE, GDF, then (I. 26) the triangles HDE, GDF are equal in every respect. ∴ HD=DF, and HE=GF.

Again, since in the two triangles HEF, GFE, HE=GF, EF is common and the angles at E and F right angles; then (I. 4) the triangles are equal in every respect, and ∴ the angle HFE = the angle GEF, and ∴ DE=DF. Q. E D.

3. Parallelograms upon the same base and between the same parallels are equal to one another.

Prop. 35, Bk. I.

Algebra.

MALES.

Answer two Questions, including (if possible) No. 2.

1. Subtract the product of $a^2+b^2+c^2$ and $a^2-b^2-c^2$ from the product of $a^2-b^2+c^2$ and $a^2+b^2+c^2$.

(1)

$$\begin{array}{r} a^2+b^2+c^2 \\ a^2-b^2-c^2 \\ \hline a^4+a^2b^2+a^2c^2 \\ -a^2b^2 \quad -b^4-b^2c^2 \\ -a^2c^2 \quad -b^2c^2 \quad -c^4 \\ \hline a^4 \quad -b^4-2b^2c^2-c^4 \end{array}$$

(2)

$$\begin{array}{r} a^2-b^2+c^2 \\ a^2+b^2+c^2 \\ \hline a^4-a^2b^2+a^2c^2 \\ a^2b^2 \quad -b^4+b^2c^2 \\ a^2c^2 \quad -b^2c^2+c^4 \\ \hline a^4 \quad 2a^2c^2-b^4 \quad +c^4 \\ a^4 \quad -b^4-2b^2c^2-c^4 \\ \hline \text{by subtracting} \quad 2a^2c^2+2b^2c^2+2c^4= \end{array}$$

$2c^2(a^2+b^2+c^2)$ Ans.

2. Prove that $a^5 \times a^7 = a^{12}$.

Reduce to lowest terms $\dfrac{a^3by^2z-ab^2y^2z^2}{aby^2z^2}$.

(*a*) Since from the notation in Algebra a^5 means that a is to be multiplied by itself five times; a^7, that a is to be multiplied by itself seven times; therefore it may be given as a rule, *that the powers of a number are multiplied by adding the exponents*, for $a^5 \times a^7 = a\times a\times a\times a\times a\times a\times a\times a\times a\times a\times a\times a = a^{12} = a^{5+7}$.

(*b*) $\dfrac{a^3by^2z-ab^2y^2z^2}{aby^2z^2} = \dfrac{a^2-bz}{z}$ Ans.

The G. C. M. $= aby^2z$.

3. Solve the equations:—

(1) $\dfrac{2x-10}{3}-15=\dfrac{3x-40}{11}-\dfrac{57-x}{5}$

(2) $\dfrac{4x+3}{2x+1}-\dfrac{3}{3x+2}=\dfrac{4x-9}{2x+1}$

(1) $\dfrac{2x-10}{3}-15=\dfrac{3x-40}{11}-\dfrac{57-x}{5}$

clearing of fractions $110x-550-2475=45x-600-1881+33x$

$110x-45x-33x=550+2475-600-1881$

$32x=544$

$x=\underline{17}$ Ans

(*b*) by transposing $\dfrac{4x+3}{2x+1}-\dfrac{4x-9}{2x+1}=\dfrac{3}{3x+2}$

$\dfrac{12}{2x+1}=\dfrac{3}{3x+2}$

clearing of fractions $36x+24=6x+3$

$30x=-21$

$x=\underline{-7}$ Ans.

Needlework.

FEMALES.

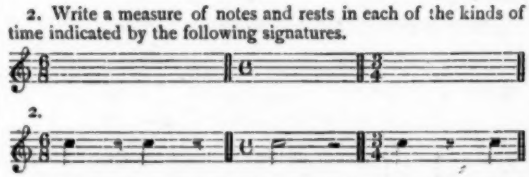
One hour allowed for this Exercise.

Music.

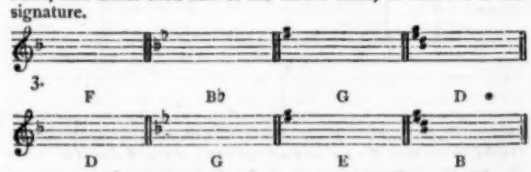
A quarter of an hour allowed for this Paper.

1. Which of the following chords are major and which minor?

2. Write a measure of notes and rests in each of the kinds of time indicated by the following signatures.



3. Write over each of the following the name of the major scale, and under each that of the minor scale, of which it is the signature.



FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or a ter,* **1st *May*, 1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. If 15 cwt. 1 qr. 2 lbs. of sugar be bought for £52 0s. 3d., at what price per pound should it be sold to gain 15 per cent.?

$$\tfrac{115}{100} \text{ of } \frac{£52\ 0s.\ 3d.}{15 \text{ cwts. } 1 \text{ qr. } 2 \text{ lbs.}} = \tfrac{23}{20} \text{ of } \tfrac{12483}{1714} \text{d.}$$
$$= \frac{23 \times 73}{200}$$
$$= \tfrac{1679}{200} = \underline{8\tfrac{79}{200}\text{d.}} \quad \text{Ans.}$$

2. If a farthing be the interest on a shilling for a calendar month, what is the rate per cent. per annum?

¼d. per shilling for 12 months = 3d. per shilling per annum.
∴ 3d. = ¼ of principal, *i.e.*, $\tfrac{12}{4}$ or $\underline{25 \text{ p. c.}}$

3. Distinguish between interest and discount. Show that the interest on £450 for 7 months at 4 per cent. per annum is equal to the discount on £460 10s. for the same time at the same rate per cent.; and explain why these two sums are equal.

Interest is the name given to any sum of money paid in return for a loan of money.

If a sum of money be due at a future time, and it is desired to discharge the debt now, a smaller sum is usually taken in payment. This smaller sum is called the present worth, or present value of the sum due at the future date, and the difference between the two sums is known as *discount*, which is simply an allowance or abatement granted in consideration of the payment of a sum of money before it becomes due.

(*a*) Interest on £450 for 7 mos. at 4 p.c. $= £450 \times \tfrac{7}{12} \times 1\tfrac{1}{25}$
$$= \frac{£450 \times 7 \times 4}{12 \times 100}$$
$$= £\tfrac{105}{10}$$
$$= \underline{£10\ 10s.} \quad \text{Ans.}$$

(*b*) Interest on £100 for 7 mos. at 4 p.c. $= £\tfrac{7}{3} = 2\tfrac{1}{3}$
Amt. of " " " $= £102\tfrac{1}{3}$.
∴ £102⅓ : £2⅓ :: £460 10s. : discount.
$$\frac{£460\tfrac{1}{2} \times 2\tfrac{1}{3}}{102\tfrac{1}{3}} = \frac{£921 \times 7}{2 \times 307}$$
$$= £\tfrac{21}{2} = \underline{£10\ 10s.} \quad \text{Ans.}$$

The sums are identical, because the true discount is the interest on the present value; and the present value of £460 10s. after the abatement is made, is £450.

4. What is the cost of the flooring of a room consisting of 36 planks each 10½ feet long, 8 inches wide, and 3 inches thick, if a cubic foot of the timber is worth 1s. 7½d.?

(*a*) (126 in. × 8 in. × 3 in.) × 35 $= \frac{126 \times 8 \times 3 \times 36}{1728}$ c. ft. = 63 c. ft.
(*b*) 63 ft. at 1s. 7½d. $= \underline{£5\ 2s.\ 4\tfrac{1}{2}d.}$ Ans.

5. If I invest £5,000 thus: three-fourths of it in 3½ per cent., stock at 92⅜, one-tenth of it in the 3 per cents at 89¼, and the rest in India 4 per cent. stock at 98¾, what annual income shall I derive from the whole investment?

Income from—
$$£3750 \times \frac{3\tfrac{1}{2}}{92\tfrac{3}{8}} = \frac{3750 \times 26}{739} = £131\tfrac{401}{739} = £131\tfrac{401}{739}$$
" $£500 \times \frac{3}{89\tfrac{1}{4}} = \frac{500 \times 12}{357} = £16\tfrac{80}{119} = £16\tfrac{80}{119}$
" $£750 \times \frac{4}{98\tfrac{3}{4}} = \frac{750 \times 16}{395} = £30\tfrac{48}{79} = £30\tfrac{48}{79}$
Total income £179 $\tfrac{4451}{5609}$
∴ Total income $\underline{£179\ 2s.\ 5\tfrac{1131}{5609}\text{d.}}$ Ans.

FEMALES.

1. If the carriage of 37 stone 6 lbs. for 7 miles cost £2 5s., what weight should be carried 12 miles for £3 10s.?

$$\left.\begin{matrix} 45s. & : & 70s. \\ 12 \text{ mls.} & : & 7 \text{ mls.} \end{matrix}\right\} :: 37 \text{ st. } 6 \text{ lbs.} : \text{weight.}$$
$$\frac{520 \text{ lbs.} \times 70 \times 7}{45 \times 12} = \tfrac{12838}{171} \text{ lbs.} = \underline{33 \text{ st. } 13\tfrac{19}{171} \text{ lbs.}} \quad \text{Ans.}$$

2. In what time will £225 amount to £256 10s. at 3½ per cent.?

Interest for the time = (£256 10s. − £225) = £31 10s.
$$\left.\begin{matrix} £225 & : & £100 \\ 3\tfrac{1}{2} & : & 31\tfrac{1}{2} \end{matrix}\right\} :: 1 \text{ year} : \text{time.}$$
$$\frac{1 \text{ yr.} \times 100 \times 63}{225 \times 7} = \underline{4 \text{ yr.}} \quad \text{Ans.}$$

3. A person buys shares in a railway when they are at £19½, £15 having been paid, and sells them at £32 9s. when £25 has been paid; how much per cent. does he gain?

Prime cost of a share = £19½, and as £10 is paid on every share ∴ by selling at £32 9s. he gains (£32 9s. − £29 10s.) = £2 19s.
$$\therefore £29\tfrac{1}{2} : £100 :: £2\tfrac{19}{20} : \text{gain p. c.}$$
$$£\frac{59 \times 200}{20 \times 59} = \underline{£10 \text{ p. c.}} \quad \text{Ans.}$$

4. A and B enter into partnership; A contributes £3000 for nine months, and B £2400 for six months; they gain £1150; find each man's share of the gain?
$$3000 \times \tfrac{9}{12} = 2250 \text{ for 1 yr.}$$
$$2400 \times \tfrac{6}{12} = 1200 \quad "$$
$$3450$$
3450 : 2250 :: £1150 : $\underline{£750}$ = A's share. Ans.
3450 : 1200 :: £1150 : $\underline{£400}$ = B's " Ans.

Grammar.

1. 'You will remember, no doubt, how *Wamba, the Saxon jester* in Ivanhoe, plays the *philologer, having noted that* the names of almost all animals, *so long as* they are *alive*, are Saxon, but when *dressed* and prepared for food *become* Norman."—TRENCH.

(*a*) Point out and analyse the noun sentences in the above, and give other examples of such sentences.
(*b*) Parse the words in italics.
(*c*) What is meant by the words *Saxon* and *Norman* in the above, and which of these has the largest share in the English language?
(*d*) Illustrate the fact noticed respecting the names of animals by examples, and if you are able to give a reason for it, do so.

(*a*) 1st noun sentence.—'How Wamba, the Saxon jester in Ivanhoe, plays the philologer, having noted' (object of 'will remember').
2nd noun sentence.—'That names of almost all animals are Saxon' (object of 'having noted').
3rd noun sentence.—'That (the names of all animals) become Norman.'

Noun Sentences.	Subject.	Enlargement of Subject.	Predicate.	Completion.
1st. How Wamba, the Saxon jester in Ivanhoe, plays the philologer, having noted . . .	(how) Wamba	the Saxon jester in Ivanhoe	plays	the philologer
2nd. that the names of almost all animals are Saxon	(that) the names	of almost all animals	are (*incomplete*)	Saxon
3rd. (*that the names of all animals*) become Norman	do.	do.	become (*incomplete*)	Norman

Other examples:—'*I heard that the Duke of Connaught had landed.*' '*We knew that such was the case.*'

(*b*) *Wamba*—noun, masc. sing. nom. to '*plays.*'
the—def. art. or dist. adj., limiting '*jester.*'
Saxon—dist. adj., limiting '*jester.*'

jester—com. noun, masc. sing. nom., in apposition with '*Wamba*.'
philologer—com. noun, mas. sing. nom. after '*plays*.'
having noted—reg. trans. verb, perfect part. active, attributive to '*jester*.'
that—conj., introducing a noun sentence.
so—adv. degree, mod. '*long*.'
long—adv. time, mod. '*are Saxon*.'
as—subord. adv. conj., introd. adverbial sentence.
alive—predicative adj., qual. '*they*.'
dressed—part. adj., qual. '*they*.'
become—irreg. intrans. verb, *become, became, become*, indic. pres. indef., 3rd pers. plur., agr. with ('*they*').

(*c*) By 'Saxon' and 'Norman' is meant that one class of words is of Saxon origin and another of Norman. Saxon was the language of the conquered race, and Norman-French that of their conquerors. The Saxon has by far the largest share in the English language.

(*d*) Saxon *sheep*, when cooked, became the French (mouton) *mutton*.
Saxon *cow, ox, bull*, when cooked, became the French (bœuf) *beef*.
Saxon *calf*, when cooked, became the French (veau) *veal*.
Saxon *deer*, when cooked, became the French (venaison) *venison*.
Saxon *swine*, when cooked, became the French (porc) *pork*.

The change of these words shows that the Saxons attended to the keeping of the animals, and to the cooking of the flesh for their Norman masters, who retained the French names.

Geography.

1. Draw a full map of South America, inserting the lines of latitude and longitude.

2. Three travellers are leaving Melbourne for England. One means to go by San Francisco, one by Suez, one round Cape Horn. Describe their routes.

The first traveller, leaving Liverpool, would sail by Queenstown across the Atlantic to New York, and, taking the cars, proceed to Chicago by the Pacific Railway, thence past Council Bluffs, Omaha, Cheyenne, Great Salt Lake City, Sacramento, to San Francisco. Thence he proceeds by steamer across the Pacific Ocean, *vid* Honolulu, to Melbourne.

The second proceeds from Southampton down the English Channel, the Bay of Biscay, along the coast of Portugal, through the Straits of Gibraltar, nearly the whole length of the Mediterranean, to Port Said, down the Suez Canal to Suez, across the Arabian Sea to Point de Galle in Ceylon, S.E. through the Indian Ocean to the S.W. corner of Australia, and along the South Coast to Melbourne.

Note.—The above journey might have been shortened by going through France and Italy to Brindisi, then proceeding by steamer to Suez Canal.

The third, leaving Southampton, proceeds southwards to the coast of Brazil, down the South Atlantic, in a south-westerly direction to the Falkland Islands, thence round Cape Horn, and across the South Pacific to Australia.

SECOND PAPER.

Two hours and a half allowed.

History.

1. What English sovereigns have lost the throne through violence? Describe the end of one of those whom you name.

	A.D.	A.D.
Harold II.	1066	
William II., Rufus	1087 to	1100
Edward II.	1307 ,,	1327
Richard II.	1377 ,,	1399
Henry VI.	1422 ,,	1461
Edward V.	1483	
Richard III.	1483 ,,	1485
Charles I.	1625 ,,	1649

The last English king who died a violent death was Charles I., who was executed 30th January, 1649. He was conducted to Whitehall by Major Harrison. Next day the Court of Justice met in Westminster Hall, and on the 27th January passed sentence of death on Charles. Two days intervened between the sentence and the execution. These were spent by Charles in devotion and in parting with his children. Bishop Juxon, who accompanied him to the scaffold, said to him, 'There is, Sir, but one stage more, which, though turbulent and troublesome, is yet a very short one. It will carry you to heaven, and there you shall find a crown of glory.' 'I go,' said Charles, 'from a corruptible to an incorruptible crown, where no disturbance can have place.' At one blow his head was severed from his body. The executioner held up the head and said, 'This is the head of a traitor.'

2. Sketch the character of George III., and explain his failure as a constitutional king.

George III. was a pious man, with the best intentions for his country's welfare, and was devoted to what he thought to be his duty. His simple, homely way of life, his plain, kindly manners, his unaffected goodness, won for him and kept for him, in spite of his grievous errors of judgment, the affection of a people knowing how to value honesty of purpose and true religion in lofty stations of life. His narrow views of things arose from the seclusion of his early life, and from an imperfect education. He had been brought up by his mother, the Dowager Princess of Wales, and by her favourite adviser, the Earl of Bute, in high notions of the royal power and prerogative. This training led him into arbitrary conduct, which he persisted in most obstinately, and which eventually brought disaster to the country.

3. What advantages is it likely that a people will derive from facilities of intercourse with foreign nations?

This is well answered by Mr. Mackenzie in 'The Nineteenth Century,' as follows:—'During the early part of the century men had scarcely the means to go from home beyond such trivial distance as they were able to accomplish on foot. Human society was composed of a multitude of little communities, dwelling apart, mutually ignorant, and therefore cherishing mutual antipathies. At once the causes of separation were withdrawn. Men of different towns, of different countries, were permitted freely to meet; to learn how little there was on either side to hate, how much to love; to establish ties of commercial relationship; to correct errors of opinion by friendly conflict of mind . . . Ancient prejudice melts away under the fuller knowledge gained by this extended acquaintance.'

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Inexhaustible*.

Write, in small hand, as a specimen of copy-setting, *One gladdening beam of cheerful light.*

Composition.

Write an essay on *Bees*.

There are two principal kinds of bees—the wild and the hive, or honey bee. The latter are divided into the *working* bees, the *drones*, and the *queen* bee. The working bees are females, and collect the honey and wax; the drones are males, and do no work; while the queen lays all the eggs, and is the mother of the hive. The bee is half an inch long, black and brown in colour, and is covered with hairs. It has a proboscis for sucking up the nectar, which she collects in her honey-bag. There are three pair of legs, the hind ones having a bag to hold the yellow dust for making wax. The lungs of the insect are under the wings; they are, in fact, open air-cells through which the bee breathes. She is also provided with a sting, which is a double dart in a sheath, having a venom-bag at its root, the poison flowing along a groove when the weapon enters the object of enmity. There are five eyes, two in front and three on the top of the head. She has also two feelers, with which it builds its cells, feeds its young, stores the hive, and caresses its friends.

The cells of the bee are arranged in the hive with great regularity; being hexagonal, they pack together better than if they had been shaped otherwise. The cells are used as storerooms for honey, and as nurseries for the young. The royal cells are situated in the centre of the hive. The young are fed by nurse

bees, on honey, pollen, and water, but the royal offspring are fed on rich jelly. Only one queen exists in a hive at one time; if two happen to meet in the same hive, they either fight till one is slain, or one leaves with a swarm for a fresh hive.

In America and other countries bees form an important branch of industry, and in our country cottagers often augment their incomes by bee-keeping. The bee has been held up to boys as an example of industry in those memorable lines of Isaac Watts—

'How doth the little busy bee,' etc.

Euclid.

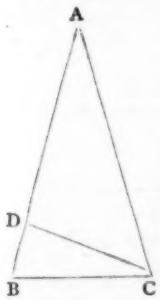
MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two questions, including No. 2, if possible.

1. If the square described upon one of the sides of a triangle be equal to the squares described upon the other two sides of it, the angle contained by these two sides is a right angle. Prop. 48, Bk. I.

2. From one of the equal angles of an isosceles triangle a perpendicular is drawn to the opposite side; show that the square on the base is equal to twice the rectangle contained by that side and the part of it between the perpendicular and the base. (Apply I., 47, then II., 4, and II., 3.)



The sq. on AC = sqs. on AD and DC, but AC = AB, ∴ the sq. on AB = sqs. on AD and DC; but sq. on AB = the sqs. on AD and DB and twice the rect. AD·DB, ∴ sqs. on AD and DB + twice rect. AD·DB = sqs. on AD and DC; take away the common sq. on AD, and the sq. on DB + twice the rect. AD·DB = sq. on DC; to each of these equals add the sq. on DB, and twice the sq. on DB + twice rect. AD.DB = sqs. on DB and DC, but (by II. 3) the rect. AB·BD = sq. on DB and rect AD·DB, ∴ twice the rect. AB·BD = sqs. on DB and DC, *i.e.* twice the rect. AB·BD = BC^2. Q. E. D.

3. If a straight line be bisected, and produced to any point, the rectangle contained by the whole line thus produced, and the part of it produced, together with the square on half the line bisected, is equal to the square on the straight line which is made up of the half and the part produced. Prop. 6, Bk. II.

Algebra.

MALES.

Answer two questions, including No. 2, if possible.

1. Find the time in which A, B, and C can together do a piece of work which A can do in a days, B in b days, and C in $\frac{1}{2}(a+b)$ days.

A does $\frac{1}{a}$ in one day; or, $\frac{ab+b^2}{a^2b+ab^2}$

B " $\frac{1}{b}$ " " " $\frac{a^2+ab}{a^2b+ab^2}$

C " $\frac{2}{a+b}$ " " " $\frac{2ab}{a^2b+ab^2}$

∴ A, B, and C do in one day $\frac{a^2+4ab+b^2}{a^2b+a^2}$;

they will do the whole in $\frac{a^2b+ab^2}{a^2+4ab+b^2}$ days $= \frac{ab(a+b)}{2ab+(a+b)^2}$ Ans.

2. Prove the rule for dividing one algebraical fraction by another, the letters standing for any numbers.

Divide $\frac{a^2+b^2}{2a^2}-\frac{2b^2}{a^2+b^2}$ by $\frac{a^2+b^2}{2b^2}-\frac{2a^2}{a^2+b^2}$

(*a*) Rule. 'Invert the divisor and proceed as in Multiplication (that is, invert the divisor, and multiply the numerators together for a new numerator, and the denominators together for a new denominator).'

For if $\frac{a}{b}$ and $\frac{c}{d}$ be the proposed fractions, and we suppose $\frac{a}{b} = x$ and $\frac{c}{d} = y$, then $a = bx$, and $c = dy$

$\therefore ad = bdx$, and $bc = bdy$;

therefore $\frac{ad}{bc} = \frac{bdx}{bdy} = \frac{x}{y}$; but $\frac{x}{y} = x \div y = \frac{a}{b} \div \frac{c}{d}$,

therefore $\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc} = \frac{a}{b} \times \frac{d}{c}$.

(*b*) (1) $\frac{a^2+b^2}{2a^2} - \frac{2b^2}{a^2+b^2} = \frac{a^4+2a^2b^2+b^4-4a^2b^2}{2a^4+2a^2b^2}$

(2) $\frac{a^2+b^2}{2b^2} - \frac{2a^2}{a^2+b^2} = \frac{a^4+2a^2b^2+b^4-4a^2b^2}{2b^4+2a^2b^2}$

Dividing (1) by (2) we have

$$\frac{(a^4+2a^2b^2+b^4-4a^2b^2)(2b^4+2a^2b^2)}{(2a^4+2a^2b^2)(a^4+2a^2b^2+b^4-4a^2b^2)} = \frac{2b^2(b^2+a^2)}{2a^2(b^2+a^2)} = \underline{\frac{b^2}{a^2}}$$

3. Solve the equations:—

(1) $\left.\begin{aligned} x+y&=a \\ ax+by&=b^2 \end{aligned}\right\}$

(2) $x^2+(x-7)^2-2x+7=32282$.

Show that the latter is the algebraical expression of the question:—'Find two numbers differing by 7 which are altogether less than the sum of their squares by 32282.

(1) $x+y=a$ or $ax+ay=a^2$

and $ax+by=b^2$

(subtracting) $(a-b)y=a^2-b^2$

$y=a+b$ A. s.

Hence $\underline{x=-b}$ Ans.

(2) $x^2+(x-7)^2-2x+7=32282$

$x^2+x^2+49-14x-2x+7=32282$

$2x^2-16x=32226$

$x^2-8x=16113$

$x^2-8x+16=16129$

$x-4=\pm 127$

$x=4\pm 127=\underline{131}$ or $\underline{-123}$ Ans.

If x = the greater number, then $x-7$ = the less.

∴ their sum $= (2x-7)$ and the sum of their squares is $x^2+(x-7)^2$.

Now if we subtract their sum from the sum of their squares, the expression is $x^2+(x-7)^2-(2x-7)$, which equals 32282, that is $\underline{x^2+(x-7)^2-2x+7=32282}$. Q. E. D.

Mensuration.

MALES.

Answer one Question.

1. Find the cost of papering a room 21 feet long, 15 wide, and 12 high, with paper $2\frac{1}{2}$ feet wide, at 9d. a yard, allowing for a door 7 feet high and 3 wide, two windows, each 5 feet high and 3 wide, and a panelling 2 feet high round the floor.

	sq. ft.	
(21 ft. × 12)2 =	504	= area of two side walls.
(15 ft. × 12)2 =	360	= " " end "
	864	

	sq. ft.	
7 ft. × 3 =	21	area of door
(5 ft. × 3)2 =	30	" windows
(42 + 30)2 =	144	" panelling

} total to be deducted 195 sq. ft.

864 sq. ft. − 195 sq. ft. = 669 sq. ft. to be papered.

$\frac{669}{2\frac{1}{2}} = \frac{1338}{5} = 267\frac{3}{5}$ ft. at 3d. a foot =

$66\frac{3}{10}$s. = £3 6s. $10\frac{1}{2}$d.

2. Find the side of an equilateral triangle, supposing it cost as much to pave the area at 9d. per square foot as to fence the three sides at five shillings per foot.

Let x ft. = the side of the equilateral triangle

then $3x$ = the perimeter in lineal ft.

and $\cdot 433x^2$ = the area in sq. ft.

$9d \times \cdot 433x^2 = 60d. \times 3x$

$3\cdot 897x = 180$

$x = \frac{180}{3\cdot 897} = \underline{46\cdot 188}$ ft.

Needlework.

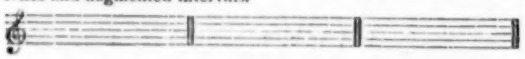
FEMALES.

One hour allowed for this exercise.

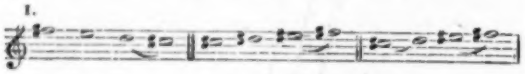
Music.

A quarter of an hour allowed for this paper.

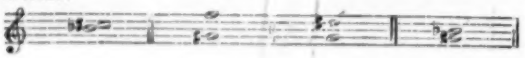
1. Write the upper tetrachord of F♯ (*Fe*) minor in every form with which you are acquainted. Mark the places of the semitones and augmented intervals.



1.



2. Write under each of the following pairs of notes the name and quality (major, perfect, diminished, or other) of the interval it forms.



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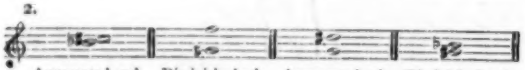
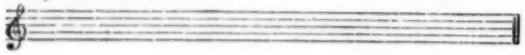
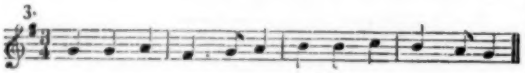


Augmented 2nd. Diminished 7th. Augmented 5th. Diminished 3rd.

3. Write, from memory, the first four or more measures of any tune you can remember.



3.



Publications Received.

Arithmetic—

(1) Comprehensive Arithmetic. Blackie and Co.

Education—

(1) The New Code. Grant and Co.
(2) Millard's Grammar of Elocution. Longmans, Green, and Co.

Geography—

(1) Map of Ireland. W. and A. K. Johnston.
(2) Elementary Atlas. Philip and Son.

Grammar—

(1) Dalziel's English Grammar. Menzies and Co.

Greek—

(1) Paley's Greek Particles. G. Bell and Sons.

History—

(1) Marshall's English History Readers. Marshall and Sons.
(2) Reep's Summary of English History. Longmans, Green, and Co.
(3) Powell's Old Stories from English History. Longmans, Green, and Co.

Miscellaneous—

(1) Prendergast's Handbook to Mastery Series. Longmans, Green, and Co.

Periodical Literature—

(1) Universal Instructor, Part XXII. Ward and Lock.
(2) Sports and Pastimes, Part V. Cassell, Petter, and Galpin.
(3) The Competitor, Part I. T. Fisher Unwin.
(4) Our Little Ones, No. 10. Griffith and Farran.

Science—

(1) Dunman's 'Talks about Science.' Griffith and Farran.
(2) Larden's School Course on Heat. Sampson Low and Co.

Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the question have been set.*]

Arithmetic.

STANDARD I.

97		7	
6		680	5×8
890		95	3×7
1000	990	1000	4×9
907	99	709	6×7
Ans. 2900	Ans. 891	Ans. 2491	

Quite, Master, Cage, Harvest, Work, Chickens.

STANDARD II.

25050		
9066	98006 × 705.	Ans. 69,094,230
	61565 ÷ 9.	Ans. 6840,—5
Ans. 15,984		

6
907
26037
5036
7080
98

Ans. 39,164

STARDARD III.

(1) From £2,000,000 take £68 19s. 11¼d.
Ans. £1,999,931 0s. 0¾d.

(2) Divide six hundred thousand by sixty-seven.
Ans. 8955—15.

(3) A boy went to the Post Office with 10s. in his pocket. He bought a sevenpenny packet of cards, 2 doz. halfpenny stamps, 4 penny receipt stamps, and 3 other penny postage stamps. What change had he? Ans. 7s. 10d.

STANDARD IV.

(1) Multiply £5017 13s. 6¾d. by 68.
Ans. £341,202 2s. 3d.

(2) Find the 7th part of £1,891,061 12s. 7¼d.
Ans. £270,151 13s. 2¾d.

(3) I want to distribute 6 lbs. 15 ozs. of sweets among 37 boys and 37 girls, giving the girls double what the boys get; what did each receive?
Ans. Boy 1 oz., girl 2 ozs.

(4) Divide £78,019 9s. 0¾d. by 819.
Ans. £95 5s. 2¾d.—306.

(5) Write out avoirdupois weight.

STANDARD V.

(1) 13068 at £1 7s. 5¾d. Ans. £17,954 17s. 9d.

	£	s.	d.
(2) Bill—3 gross at 4½d. per doz. ...	0	13	6
1 pt. Ink at 7s. per gallon ...	0	0	10½
1 gross at 6 for 5d.	0	10	0
3 reams at 6d. per quire ...	1	10	0
2000 envelopes at 9d. per 100	0	15	0
Ans.	£3	9	4½

(3) 7 cwt. 3 qrs. 19 lbs. 11 ozs. at £37 12s. 6d. per ton. Ans. £14 18s. $2\frac{2}{3}\frac{1}{5}\frac{1}{6}$d.

(4) If a bankrupt owes £4726 10s., and his effects are worth £1181 12s. 6d., how much will he pay in the £? Ans. 5s.

STANDARD VI.

(1) 4 qts. 3 pts. to the decimal of 1 barrel.
Ans. ·038194.

(2) If a watch gains 20 mins. 4 secs. in 12 days 4 hrs. 23 mins., what would a similar watch gain in 12 yrs. 3 mths. 4 wks. 20 mins., at the same rate?

This question is puzzlingly indefinite in the last term, so that out of any number working it, scarcely two could be expected to get the same result. *We* have reckoned the years as 365 days each + 3 days for leap years, and the 3 months as $\frac{1}{4}$ of 365 days; giving a total of 4502d. 6h. 20m. = 6,483,260m. And 12d. 4h. 23m. = 17,543.

Then $6\frac{4\,5\,3\,2\,6\,0}{1\,7\,5\,4\,3}$ of 1204 scs. = 444954$\frac{1\,7\,0\,1\,8}{1\,7\,5\,4\,3}$ scs. =
Ans. 5d. 3h. 35m. 54$\frac{1\,7\,0\,1\,8}{1\,7\,5\,4\,3}$ sec.

(3) Divide ($\frac{6}{7}$ of 4) by ($\frac{2}{3}$ + $\frac{2}{3}$). Ans. $2\frac{6\,2}{7\,7}$.

(4) If a lady spent $\frac{1}{6}$ of her money in one shop, $\frac{1}{5}$ in another, and had £5 1s. 4d. left, how much did she start with? Ans. £8.

(5) What would be the weight of 9 crowns, 10 half-crowns, 12 sixpenny bits, and 13 fourpenny bits, if 66 shillings were coined to a lb. (Troy)?
Ans. 1 lb. 2 oz. 12 dwts. $2\frac{1\,0}{1\,1}$ gr.

Algebra.

(1) Find the value of $2\left\{3x-4y-3\left(5x-y\right)\right\}$
When x = 3 cwt. 3 qrs. 18 lbs.
y = 1 ,, 13 ,,
Ans. − 4 tons 14 cwts. 2 qrs. 10 lbs.

(2) Find the value of $\frac{1}{3}\left(7x-5y\right)-\frac{1}{5}\left(6y-2z\right)$.
When x = £1 1 0
y = 0 6 8
z = 0 3 4
Ans. £1 11s. $2\frac{9}{1\,0}$d.

(3) Express algebraically x mins. past 10, and y mins. to 11 o'clock, and find the difference between these two times. Prove your answer by putting x = 20′ and y = 15′.

Ans. $-10+\frac{x}{60}$; $11-\frac{y}{60}$; $1-\frac{x}{60}-\frac{y}{60}$; 25 mins.

(4) If a man buys $x+y$ articles at 5s. per piece, and sells x of them at 4s., and the rest at 6s., how much does he gain? What does the answer become when x = 12 and y = 8? Explain your answer.
Ans. $y-x$; 4s. loss.

(5) a = 0 b = 5 c = 3 d = 10.
Find value of $\frac{ab+2bc-3cd}{2a+3b}$ and $\frac{a^2-b^2+c^2}{3bc}$.
Ans. -4; $-\frac{1\,6}{4\,5}$

(6) How would you express, algebraically, that a thermometer is 5° below zero? What would the temperature become if − 3° were subtracted from it?
Ans. − 5°; − 2°.

Euclid.

(1) Bisect the angle PQR. Ans. Euclid I. 9.

(2) From the point D, not in the line FG, draw a perpendicular to FG. Ans. Euclid I. 12.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR SEPTEMBER, 1882.

EXERCISE X.

(1) $a^3+a^2b+a^1b^2+b^3$. (2) $a^3+a^2b+ab^2+ac^2+b^3+bc^2$. (3) $6x^2+13xy+6y^2$. (4) x^3-5x^2+9x-9. (5) $a^2+3ac-4b^2-6bc$. (6) $x^3-ax^2-a^2x+a^3$. (7) $x^4-2a^2x^2+a^4$. (8) $8a^2b^2-4ab^3-12b^4$. (9) $a^2+2ab+b^2$. (10) $4a^2+4b^2+4c^2+8ab+8ac+8bc$. (11) $x^2+y^2+z^2+2xy+2xz+2yz$. (12) $a^3+3a^2b+3ab^2+b^3$. (13) $a^2-b^2+2bc-c^2$. (14) $36a^2-30ab-36b^2$. (15) $-6a^5b^2-12a^4b^2c^2+a^3b^3+2a^2b^2c^2$. (16) $10x^2y^3-8x^2y^2z$.

EXERCISE XI.

(1) $a^2-2ab+b^2$. (2) m^2+mn+n^2. (3) $y^2-2yz+z^2$. (4) m^2-n^2. (5) a^2+4a+4. (6) $9a^2+12ab+4b^2$. (7) a^2-b^2. (8) x^2-1.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR SEPTEMBER, 1882.

STANDARD III.

A. 1. 3,717,398—7.
2. 442,436—8.
3. 2170—330.

B. 1. 6942—76.
2. 83,008—929.
3. £3317 5s. 6½d.

C. 1. £84,379 5s. 4d.
2. 6558—28,850.
3. £499 2s. 1½d.

D. 1. 223—37,659.
2. £29 3s. 9d.
3. £136 16s.

E. 1. 7,204,134.
2. £14 11s. 1d.
3. £1854 18s. 4d.

F. 1. 136 rem.
2. £542 5s. 5¾d.
3. 1304—65,586.

ADVANCED EXAMINATION.
1. £33 6s. 8d.
2. £3 19s. 1½d. saddle; £1 6s. 4½d. bridle.
3. £1 6s. 1½d.

STANDARD IV.

A. 1. £34,c82 9s. 0¾d.
2. £75,825 2s.
3. £452 6s. 10¾d.—15.

B. 1. £12,894 17s. 9d.
2. £83 17s. 9¾d.—202.
3. 13 408,500 sec.

C. 1. £84 11s. 7¾d.—8971.
2. 29.395,275 farth.
3. 223 tons, 10 cwt., 3 qrs, 27 lbs., 1 oz.

D. 1. 245,025 sq. ft.
2. 15s. 5¾d.—42,257.
3. 617,760 inches.

E. 1. £3457 19s. 9d.
2. 200,375 grains.
3. 216 tons 8 cwt. 2 qrs. 15 lbs.

F. 1. 429,906,432 dr.
2. 2212 books.
3. 4014,489,600 inches.

ADVANCED EXAMINATION.
1. £25 0s. 6d. gain.
2. 7½d an hour.
3. Sept. 23rd, at 1.14 a.m.

STANDARD V.

A. 1. £580 8s. 10½d.
2. £668 11s. 5½d.
3. £3294 12s. 2½d.

B. 1. £689 15s. 3¾d.
2. £2058 9s. 11½d.
3. £7825 17s. 2¾d.

C. 1. £2751 10s. 6½d.
2. £5643 18s. 6¾d.
3. £113,763 8s. 10½d.

D. 1. £4 13s. 2¾d.
2. £4805 13s. 10$\frac{3}{1\,0}$d.
3. £11 3s. 9½d.

E. 1. £927 16s. 6½d.
2. £20 0s. 8d.
3. 143½ lbs.

F. 1. £36 1s. 5¾d.
2. £261 14s. 4½d.
3. £564 15s. 8¾d.

ADVANCED EXAMINATION.
1. 7s. 6d. each girl.
2. £30 12s. 9d.
3. 20 days.

STANDARD VI.

A. 1. $3\frac{3\,3}{1\,1\,6}$.
2. $\frac{1}{3}$.
3. $9\frac{1}{1\,8}$.

B. 1. 2·3705.
2. 22·455.
3. 3s. 10$\frac{3}{1\,0}$d.

C. 1. 105$\frac{1\,1}{1\,2}$ shirts.
2. $\frac{2}{3}$.
3. 2s. 7$\frac{1}{1\,2}$d.

D. 1. $6\frac{3}{8}$ days.
2. $\frac{1\,1\,0\,0\,8}{1\,7\,1\,7\,5}$.
3. 3914·45625.

E. 1. £28 11 $6\frac{3\,3\,3}{1\,0\,7\,5}$d.
2. 19s. $1\frac{1\,1}{3\,0}$d.
3. £9 14s. $0\frac{1}{4}$'.

F. 1. $\frac{3}{5}$.
2. £9 13s. $11\frac{7}{1\,1}$d.
3. £59 5s. 2¾d.

ADVANCED EXAMINATION.
1. 11½ days.
2. £175.
3. $\frac{4\,6\,1}{1\,6\,9\,9}$ cwt.

STANDARD VII.

A. 1. £118 2s. 10½d.
2. 5½ per cent.
3. 3s. 9d. in the £.

B. 1. £575 5s.
2. 6$\frac{1}{11}$ per cent.
3. £60 19s. 0$\frac{4}{7}$d.

C. 1. £215.
2. 8s. 0$\frac{1}{2}$d.
3. 4$\frac{3}{5}$ per cent. average.

D. 1. £3133 6s. 8d.
2. £90 10s. 6·336d.
3. 3·38 per cent.

E. 1. £1 7s. 11$\frac{1}{4}\frac{7}{9}$l.
2. £5025.
3. 3s. 10$\frac{1}{2}$d. each hat.

F. 1. £787 10s.
2. £25 18s. 6$\frac{3}{4}$d.
3. 5$\frac{7}{1\,3\,1}$ years.

ADVANCED EXAMINATION.

1. £4 14s. 10$\frac{4}{5}$d.
2. £1583 13s. 0$\frac{1}{2}$d.
2. £30 11s. 9$\frac{3}{1\,7}$d.

SOLUTIONS OF THE 'ADVANCED EXAMINATION' QUESTIONS IN 'THE SCHOLAR,' FOR SEPTEMBER, 1882.

STANDARD III.

1. 60,000 = 3000 score, which at 9d. = 27,000d.
60,000 = 5000 dozen, ,, 7d. = 35,000d.
35,000d. − 27,000d. = 8000d. = £33 6s. 8d. Ans.

2. £50 − (42g. + 12s. 6d.) = £5 5s. 6d. cost of S. and B. As the saddle costs 3 times as much as the bridle, the two cost *four* times as much as the bridle, hence £5 5s. 6d. ÷ 4 = £1 6s. 4½d. bridle, and £1 6s. 4½ × 3 = £3 19s. 1½d. saddle. Ans.

3. 4s. 9d. × 4½ = £1 1s. 4½d. father's earnings.
£1 1s. 4½d. + 4s. 9d. = £1 6s. 1½d. Ans.

STANDARD IV.

	s.	d.		£	s.			
1.	4	6 × 300	=	67	10	received for	300	yds.
	3	9 × 140	=	26	5	,,	140	,,
	2	9 × 36	=	4	19	,,	36	,,
	2	3 × 124 (rem.)	=	13	19	,,	124	,,
				£112	13	,,	600	,,

Hence £112 13s. − £87 12s. 6d. = £25 0s. 6d. Ans.

2. 7s. 6d. × 20 = £7 10s. amount received for the work.
6 × 5 × 8 = 240 number of hours' work done.
£7 10s. ÷ 240 = 7½d. Ans.

3. 71,609 min. = 49 d. 17 hrs. 29 m.
The remainder of August is 27 d. 16 hrs. 15 m.
The extension into September is 22 d. 1 hr. 14 m.
This gives the date September 23rd at 1-14 a.m. Ans.

STANDARD V.

1. Bringing the men and the girls to their equivalents in boys we have 18 men = 108 boys, and 60 girls = 90 boys; then 108 + 0 + 12 = 210 boys. £52 10s. ÷ 210 = 5s. a *boy's* share, and 5s. × 1½ = 7s. 6. Ans.

2.

		s.	d.		£	s.	d.
18½	at	6	9	=	6	3	2½
163¼	at	1	4½	=	11	4	9¾
8¾	at	11	9	=	4	16	11½
3½	at	16	3	=	3	0	11½
28½	at	3	9	=	5	6	10½
		Total			£30	12	9 Ans.

3. As 10 men = 15 women, 1 man = 1½ women, and 8 men = 12 women, which added to the 6 actual women = 18 w. Having eliminated the men we have (24 d. × 15) ÷ 18 = 20 days. Ans.

STANDARD VI.

1. Bringing the different consumers to their equivalents in *one* of them—say girls, the lowest in the scale being generally the easiest—we have 40 men = 80 girls, 60 women = 96 girls, 90 boys = 120 girls, and these added to the 100 girls = 396 girls. The question is now simply,—If 16 girls consume 50 lbs. of beef in 11 days, how long would 1250 lbs. last 396 girls? Then by proportion—

$$\frac{11 \text{ days} \times 16 \times 1250}{396 \times 50} = 11\tfrac{1}{3} \text{ days. Ans.}$$

2. As he pays away ⅓ at last payment, and has £5 left, he must have had £10 *before* last payment, or *after* third payment. As the third payment was ⅔ of the money in hand, the £10 left must be ⅓ of what he had after third payment, hence he must have had £40 *before* third payment or *after* the second. This second payment being ⅜, the £40 must be ⅓; hence he had £120 after first payment. But this £120 must be ⅔ (as he paid ⅓) of what he had at first, then (£120 ÷ 2) × 3 = £180, amount to begin with; hence £180 − £5 = £175. Ans. Expressed concisely the original amount is £5 × $\frac{3}{1}$ × $\frac{4}{3}$ × $\frac{3}{2}$ × $\frac{3}{2}$ = £180.

3. £79$\frac{7}{1\,7}$ = 38,200 halfpence; 2½d. = 5 halfpence. Hence $\frac{5}{3\,8\,2\,0\,0}$ = $\frac{1}{7\,6\,4\,0}$ represents the fraction of the money spent, and consequently the fraction of the coal bought. Then $\frac{1}{7\,6\,4\,0}$ of 115½ tons = $\frac{1}{7\,6\,4\,0}$ of $\frac{2\,3\,1}{2}$ × $\frac{2\,0}{1}$ = $\frac{4\,6\,2\,0}{7\,6\,4\,0}$ cwt. Ans.

STANDARD VII.

		£	s.	d.	
1.	25 guineas or £26 5s. × 18 =	472	10	0	rents due.
	£472 10s. − 5 per cent. =	448	17	6	,, received.
	£448 17s. 6d. − 7½ per cent. =	415	4	2½	net receipts.
	£415 4s. 2½d. ÷ 87·5 (hund.) =	4	14	10$\frac{1}{2}\frac{3}{5}$	Ans.

2. £22 10s. × 305 = £6862 10s. yearly receipts. As he gains 30 per cent., the goods that cost £100 sell for £130, hence the cost of the goods is $\frac{1\,0\,0}{1\,3\,0}$ = $\frac{1\,0}{1\,3}$ of their selling price, and the profit must be $\frac{3}{1\,3}$, then $\frac{3}{1\,3}$ of £6862 10s. = £1583 13s. 0½d. Ans.

3. £5980 ÷ 92 = 65 hundred of stock bought.
£4 × 65 = £260 interest from this stock.
£95 × 65 = £6175 received on selling out.
£6175 ÷ 127½ = 48$\frac{4}{5}$ hundred of 6 per cent. stock.
£6 × 48$\frac{4}{5}$ = £290$\frac{4}{5}$ interest from 6 per cent. stock.
£290$\frac{4}{5}$ − £260 = £30 11s. 9$\frac{3}{5}$d. increase. Ans.

CRYSTAL PALACE.—The award of Scholarships and Prizes to students in the Ladies' Division of the Crystal Palace School of Art, Science, and Literature was recently completed, when Mr. Edwin Long, R.A., Mr. Joseph J. Jenkins, F.S.A., R. Soc. P.W.C., and Mr. G. Elgar-Hicks adjudicated on the work of the students in the Art classes. The medal for water-colour painting (landscape, architecture, etc.) was given to Mrs. Edward Milner (née Miss Hamilton), the certificate to Miss S. E. R. Horton, to whom the scholarship in art was adjudged; the medal for water-colour painting from the life to Miss J. M. Bethune, the certificate to Miss Lina Newall; the prize for drawing from the antique to Miss M. Flood Page; the certificate for drawing from the life to Miss E. S. Norton. The scholarship in music has been adjudged to Miss Alice Ferrier; the scholarship in modern languages, literature, etc., to Miss Elsie Atkins.

Instructions to H.M. Inspectors.

THE Amended Code came into force on the 6th April, and as every school whose annual inspection is due after April 30th, 1883, will be subject to its provisions, teachers have anxiously looked for the publication of this promised Circular, which, it was understood, would contain specific regulations as to the conduct of the examination, as well as some more definite statements as to the meaning and application of certain articles of the Code. The document now issued will, in these and, we believe, in all other respects, prove generally satisfactory. The spirit which pervades it accords with the previously professed purposes of the Vice-president; and though the 'Mundella Code' is not all that teachers would desire, this Circular will doubtless tend to strengthen the faith of the profession, as well as of the public in general, in its probable beneficial results.

The inspectorate is now being reorganized. Sub-inspectors—a new class—are to act under district inspectors, who, grouped within certain territorial limits, will themselves be supervised by senior divisional inspectors. By 'mutual agreement' on the part of the senior inspectors there will be established a certain standard of examination for uniform application in all the schools of England and Wales. 'Occasional conferences' will be held for the purpose of comparing 'sums set and passages dictated,' etc., in order that uniformity of test may be maintained; for the standard determined upon must be 'faithfully observed in each district.' 'Startling differences' in the average percentages of adjoining districts are by these prudent arrangements not likely to exist in future, especially when all H.M. inspectors shall have effectively undergone the 'special training' prescribed henceforth as a preliminary to an appointment. The divisional inspector will hereafter personally attend to all proper appeals from the reports of district inspectors, should any such appeals be made.

This Circular is the necessary complement of the reorganization of the inspectorate in connection with the provisions of the New Code. Each of its forty-five sections demands careful examination by managers and teachers, especially by the latter, for whom many of the 'Instructions' are evidently designed. H.M. inspectors, for example, do not require to be officially told that 'it is often a help in calculation if the dimensions of the schoolroom, the playground, and the desks, and the weight of a few familiar objects are accurately known and recorded,' or to be informed that 'it is useful to mark on the floor of the schoolroom the meridian line,' and other matters of that sort.

But those 'Instructions' which relate to the official duties of inspectors are of an eminently practical character, and the details given tend directly to secure the universal application of one and the same standard of judgment. The great majority of the inspectors, it is generally acknowledged, have ever acted with impartiality, and the whole body of teachers would join with 'My Lords' in crediting them with great 'courtesy, patience,' and gentlemanly conduct. The second paragraph of the Circular indicates that there are at least complaints of the occasional absence of these virtues, and also of 'a want of due consideration in the treatment of teachers and scholars.' The want of 'sufficient time' is, no doubt, a frequent cause of the evils complained of, and the few unpunctual inspectors are urged in very intelligible terms to an 'early attendance,' in order to avoid that 'undue haste' which 'is incompatible with the proper discharge of your main duty.' Laws are not made for the righteous, and 'My Lords,' in insisting that there be no 'hurry' in conducting an examination, will cut off a chief source of discontent. The preferences or prejudices, and the special tastes or idiosyncrasies of examiners have occasionally called forth complaint, but the stringent regulations of this Circular will, if 'faithfully observed,' almost entirely eliminate the importance hitherto attached to the 'personal equation.' In the interests of education, as well as in the interests of justice, every district should be under one common influence, which should actuate teachers to work confidently towards one common result. When the reorganisation of the inspectorate has been completed, and when all its officers are experienced in their duties, we may venture to predict that under the new *régime* the senior inspector will have few 'appeals' to distract his attention from the more congenial work of stimulating true educational progress within the limits of his own division.

The marks 'Fair' and 'Good' are to be assigned generally on principles the justice of which will be readily accepted. At least fifty per cent. of the scholars must pass to gain the former mark, and seventy-five per cent. to win the latter. This general 'scale' applies particularly to the 'class' and specific subjects. In small schools, and in some others, teachers will, with regret, find it, in most cases, impossible to include any of the 'specifics' in their course of instruction. The reasons which have determined this virtual exclusion will be studied with care. Where the upper standards are numerous, specific subjects 'may be encouraged,' but 'My Lords' have no intention 'to encroach in any way on the province of secondary education.' The Sixth Standard is even now often reached at twelve years of age, and an increasing number of scholars will in many schools reach the Seventh Standard young enough to require provision for extra instruction in the day-school. The possible introduction of class and specific subjects into the 'varied teaching' of evening schools will tend to revive many such schools that are now languishing, and to create many others, to the great intellectual and moral benefit of the country. The exclusion of 'specifics' will nevertheless be felt in some small day-schools.

The regulations for presentation and for re-presentation on the day of inspection seem to be justly and generously interpreted. No scholar will fail in writing and arithmetic on account of a disabled hand or loss of eyesight, etc. 'Delicate health, obvious dulness, and defective intellect' will probably include all the additional cases which teachers would desire to withdraw from the examination, and 'reasonable excuses' for the absence of scholars will be readily allowed. Since, at present, managers mostly measure success by the percentage of passes; and as this amount, multiplied by the average attendance, will determine the greater part of the Government grant, the reputation and, not unfrequently, the income of the teacher will largely depend upon the magnitude of each of these important factors. Thus temptations to teachers still exist, but their force is not so direct as before. Should the integrity of any teacher seem to yield under pressure, the Code now happily provides that

no penalty shall be inflicted without giving the accused an opportunity of personal explanation. The suspension of a certificate will be esteemed by the profession a mild punishment for one who is convicted of deliberate and systematic falsification of the registers or of any kind of school returns. 'Special care on the part of managers, and watchfulness' on the part of inspectors are strictly enjoined in view of the altered basis on which the grant is made; but we believe that cases of 'tremendous fraud,' though not numerous in the past, will be still fewer in the future. There ought to be no more honourable men in any state than those who have to mould the character of its youth.

Severe as the Department will justly be upon every proved instance of 'false registration,' there is reason to believe that, on the other hand, local authorities who are careless as to the attendance of children at school will be visited with at least equal severity. 'Cases of gross neglect on the part of the authorities should form the subject of a special report to the Department.' Irregularity due to such neglect is to modify H.M. Inspectors' 'judgment of the school.' Neither teachers or managers can be fairly held responsible when, as is now too often the case, attendance committees entirely fail in the discharge of their duties. It was the beginning of a new epoch in the history of this country, when, in 1876, Mr. Forster placed as the first clause of an Act of Parliament, the pregnant declaration:—'It shall be the *duty* of the parent of every child to cause such child to receive efficient elementary instruction in reading, writing, and arithmetic; and if such parent fail to perform such duty, he shall be liable to such orders and penalties as are provided by this Act.' Local authorities are not only bound to make known this 'legal obligation,' but also to enforce it. The Education Department appears to be earnestly resolved to see that these duties shall not be lightly disregarded. The enforcement of the law will materially contribute to the comfort of teachers as well as to the benefit of the children.

This remarkable Circular on the administration of the Code, whilst seeming to demand the highest possible results of instruction, nevertheless contains many passages which urge H.M. inspectors to make 'reasonable allowance for special circumstances.' Some subjects, like cookery, in girls' schools, *must* be taught by a 'duly qualified teacher'; and 'a special teacher' of specific subjects is suggested for 'groups of schools' where such an arrangement is possible. 'Good teachers' are to be allowed greater freedom of choice as to 'class' and 'specific' subjects; to the '*quality* of the instruction' is to be attached 'increased weight,' and on every page there are plain indications that the Department is anxious that the very best type of school suited to any given locality should there be established. Paragraph 32 points out the general conditions on which 'a thoroughly good school' may obtain the mark of 'distinguished merit,' and be reported as 'excellent.' These conditions are numerous, and can only be satisfied by a large expenditure on the part of the managers, and by superior ability on the part of the head teacher and the rest of the staff. 'It is hardly to be expected that any one school will completely satisfy all these conditions,' but it is well that there should be a lofty ideal to contemplate. 'Above all'—this is the crowning point—'its teaching and discipline are such as to exert a right influence on the manners, the conduct, and character of the children —to awaken in them a love of reading, and such an interest in their own mental improvement as may reasonably be expected to last beyond the period of school-life.

The tendency of the Revised Code of 1861 was to make teaching mechanical, and one of H.M. inspectors, in comparing it with the Minutes previously in operation, gave, as reasons for its 'superior nature,' the 'all but absolute certainty upon, at all events, the attainments required,' and the power 'to apply praise or blame with an amount of firmness and precision which, under the former Code, I was unable to do' (Minutes, 1866-7. Vol. i., p. 16). Educationists, however, felt that that Code was defective in not recognising some results which they deemed of greater importance than the three R's, and the merit grant of the New Code is a concession to their oft-repeated remonstrances. The inspector himself must assess this grant, and 'there is no graver or more difficult task' imposed upon him in the round of his official duties. If he is guided by the 'passes' alone, the majority of schools will obtain the mark 'good'; the average at present is 82·6, or seven per cent. above the required number. But a generous regard to the *quality* of instruction, and the other elements of excellence, so graphically enumerated in section 32, as well as to the difficulties with which some schools have to struggle, will further increase the proportion. 'Deductions by tenths' may still occur, but the steady growth of correct sentiments as to the value of true education to the individual and to the nation will ultimately secure, even for the smallest school in the kingdom, an efficient staff, and the 'mark of distinguished merit' more frequently than the fines which have been often due to defective management. The power of inspectors is, doubtless, very much enlarged. Their 'estimate of the merit of the school as a whole' should 'be the result of several factors of judgment,' and must depend upon their judgment of factors. With more exact rules for guidance errors are possible, and grounds for the award of 'fair,' 'good,' or 'excellent,' need not be given. Infants' schools are, perhaps, most liable to be misjudged with reference to the merit grant, which in their case is a more important item of income. Teachers generally will care far more for their reputation than for the finance, as in the majority of schools the extra shilling will not make a very serious difference in the total amount.

But nothing human is perfect. The New Code has already been amended.* As time progresses further revision will be needed. The Earl Spencer and Mr. Mundella availed themselves of the practical wisdom of the country in drawing up the Code, and in the Circular before us the intentions of the Department are more fully expressed. If, in the administration of the 'regulations,' the spirit which dictated these 'Instructions' shall be universally predominant among the inspectors, the discharge of 'new duties,' 'delicate and onerous' as they are, will be accompanied with 'carefulness, insight, and sympathy' 'in a higher degree than ever.' Managers will be stimulated to a more ready co-operation, and teachers, conscious of a real and sympathetic support, will labour with greater hope for the benefit of their country. The 'Mundella Code' was an advance on its predecessors; the Instructions make it better still.—*Majora canamus.*

* Art. 109 has been amended, so that (f.) (i.) 5 omits '*in mixed schools*;' and (f.) (vi.) therefore provides that all 'girls [in any school] may take needlework as their second "class" subject.'

Instructions to Her Majesty's Inspectors.

CIRCULAR NO. 212.

Education Department, Whitehall. August, 1882.

SIR,—1. The changes which have recently been introduced into the Code, and the proposed reorganisation of the work of inspection, entail a review of the instructions given in some previous circulars for the guidance of inspectors in their inspection and examination of schools.

Examination and Inspection Generally.

2. Before entering into details of principles and methods of examination, my lords would especially call your attention to the general principle, that all hurry or undue haste on the day of examination, is incompatible with the proper discharge of your main duty—that of ascertaining, verifying, and reporting the facts on which the Parliamentary grant is administered. Their lordships gladly acknowledge the great courtesy, patience, and industry with which the inspectors have, as a body, discharged the difficult duty of collecting the numerous particulars required for an accurate judgment of each scholar's work in detail, and of the school as a whole. But instances have occurred in which managers have complained of unpunctuality, haste, and impatience, and of a want of due consideration in the treatment of teachers and scholars. It may be fairly inferred that such complaints would not arise if sufficient time were given to each inspection. An early attendance at the school is absolutely indispensable, not only on account of the greater length of time available for work, but in the interests of the children, who are far more capable of sustained exertion in the early part of the day. A hurried inspection probably necessitates some evils, which are much to be deprecated—the attempt to do two things at once, *e.g.*, to give out dictation or sums while hearing the reading of another class; keeping classes unemployed instead of dismissing them to play; retaining children in school in the dinner hour and thereby not allowing sufficient time for the meal; prolonging the examination to a late hour in the afternoon; and embarrassing young scholars by want of clearness in dictation or in asking questions.

Uniformity of Standard.

3. It is not necessary in this circular to enter into minute details as to the rules to be observed in examining schools. It may be expected that practical uniformity will be obtained by the arrangements recently made for conference and agreement on the part of the senior inspectors, whose duty it will be to see that the rules approved by the Department are uniformly observed by the district inspectors in their respective divisions. My lords do not propose to interfere with the methods by which each inspector may prefer to arrive at results, but will expect that the standard obtained by the mutual agreement of the senior inspectors, and approved by their lordships, shall be faithfully observed in each district. For this purpose occasional conferences will be held in each division with a view to compare sums set and passages dictated in each standard, questions asked in class or specific subjects, and the methods and results of inspection generally. Uniformity of standard will also be further secured by the proposed special training of all inspectors who may hereafter be appointed.

Appeals.

4. Appeals from the reports and recommendations of inspectors have not been frequent in the past, and will probably be even less frequent in future, when a uniform standard of examination is applied throughout the districts. But if any complaint of real or apparent hardship should be laid before the Department, the case will be referred by their lordships to the senior inspector of the division for personal inquiry and report, wherever the facts alleged seem to justify such a reference.

Infants' Schools and Classes.

5. Under Article 106 of the Code, the entire grant to an infants' school or class will be computed on the average attendance, and not as heretofore, in part, on the number of children present on the day of inspection, and on the number of passes obtained in the standard examination. The children, apparently above six, should, however, be individually examined, and a sufficient number of the others to satisfy you that the elements of reading, writing, and arithmetic, are properly taught. The Code assumes that, besides suitable instruction in these elements, and in needlework and singing, a good infants' school should provide a regular course of simple conversational lessons on objects, and on the facts of natural history, and a proper variety of physical exercises and interesting employments. In the best schools, the list of collective lessons is prepared by the head-teacher three months in advance, and is entered in the log-book. The managers of a school in two or in three departments are at liberty to place the scholars of Standard I.—usually between seven and eight years of age—either in the infants' department, or with the older children; but when the former plan is preferred, the course of lessons should include simple recitation and lessons in geography or elementary science, to correspond to the class-subjects intended to be taken up in the boys' or girls' school. It should be borne in mind that it is of little service to adopt the 'gifts' and mechanical occupations of the Kinder-Garten unless they are so used as to furnish real training in accuracy of hand and eye, in intelligence, and in obedience.

Award of Grant.

6. An infants' school or class may be deemed 'Fair' when more than half of the scholars examined prove to have been satisfactorily taught in reading, writing, and arithmetic; when discipline and singing are fairly good; and when one of the requirements specified under (2) and (3) in Article 106b* is fairly fulfilled. When both of those requirements are fairly fulfilled; when not less than three-fourths pass the individual examination well; and when discipline and singing are satisfactory, the mark 'Good' should be awarded. A school or department should not be called 'Excellent' unless all three requirements of the article are thoroughly well satisfied. No merit grant should be given in any case in which the infants' class is left in the sole charge of a monitor. The time-table should show what portion of the daily instruction is given by the head or some other adult teacher.

Standard Subjects.—Reading.

7. The Code requires that in all standards higher than the second three reading books shall be provided. More than three sets of books are not necessary in any standard; an ordinary reading book will provide a sufficient amount of good literature for exercises in the art of reading and for all the purposes of teaching 'English' if taken as a class subject: in the third and higher standards the second reading book will be a historical reader; the third book will be a geographical or scientific reader, to correspond to the second-class subject. In schools in which no second-class subject is taken, the third book may be, like the first, an ordinary reader. In Standards I. and II. two ordinary reading-books may be used, unless the managers prefer that the second book should be a geographical or scientific reader, to suit the second-class subject. In Standards V., VI., and VII. books of extracts from standard authors may be taken, though such works as 'Robinson Crusoe,' Voyages and Travels, or Biographies of eminent Men (if of suitable length) are to be preferred. In Standards VI. and VII. a single play of Shakespeare, or a single book of one of Milton's longer poems, or a selection of extracts from either poet equal in length to the foregoing, may be accepted. As a rule, ordinary text-books or manuals should not be accepted as readers.

8. In Standards I. and II. intelligent reading will probably suffice to justify a pass without much examination into the matter of the book; but it should be considered a grave fault if children have been allowed to read the same lesson so often as to learn it by heart, and to repeat it without any but occasional glimpses at the book. The mechanical difficulties of reading, which are to be found in the shorter words of irregular notation, should be mastered before Standard III. is reached. As a general rule, but especially in the lower standards, the examiner should be careful rather to ask for the meaning of short sentences and phrases than to require explanations of single words by definitions or synonyms.

Writing.

9. In Standard I. the writing exercises should, as a rule, be done on slates, and should be regarded chiefly as a test of *handwriting, i.e.*, of the child's power of making and combining script letters (small and capital), and accurately transcribing print. My

* Art. 106 (*b*): 'A merit grant of 2s., 4s., or 6s., if the inspector reports the school or class to be fair, good, or excellent, allowing for the special circumstances of the case and having regard to the provisions made for (1) suitable instruction in the elementary subjects, (2) simple lessons on objects and on the phenomena of nature and of common life, and (3) appropriate and varied occupations.'

lords do not pledge themselves to any particular style of writing or method of teaching it, but it should at least be bold and legible, and the text adopted should be sufficiently large to show that the child is acquainted with the proper forms and proportions of letters. In dictation none but the easiest and most familiar words, and those chiefly monosyllables, should be given out, and a pass should not be withheld if six out of the prescribed ten are correctly spelt and written. In Standard II. the exercises should be on slates, security for writing on paper being provided by the exhibition of copybooks. The same qualities of writing should be required as in Standard I., but greater importance should be attached to evenness and uniformity, and to proper spaces between the words. Capitals should be required to be put without direction after full stops and at the beginning of proper names. The passage for dictation should be carefully selected as being of average difficulty, and free from puzzling words. As children may generally be expected to pass easily in the mechanical art of writing at this stage, five mistakes in spelling ought, as a rule—if the passage selected be sufficiently easy—to involve a failure. In Standard III., and those above it, the examination should always be on paper. Greater readiness should be expected in writing, but two or three words only should be dictated at once. As a rule, more than four errors in spelling should involve failure; but, if the handwriting be *very fair*, and not more than four errors in spelling occur in the six lines, the child should pass. Correct spelling should not, in any case, obtain a pass if the writing is below *fair*. In Standard IV., and those above it, writing should be running, free, and symmetrical, as well as legible and clear. If poetry is selected for dictation, the scholars should be made clearly to understand before beginning to write where each line commences and ends. A pass should not be withheld if the writing is *fair*, and the errors in spelling do not exceed three.

10. In Standard V. the passage selected for writing from memory should be an anecdote occupying from ten to fifteen lines of ordinary length, and containing some sufficiently obvious *point*, or simple moral. The passage may, if the teacher desires, be read out aloud by him. Neither accuracy in spelling nor excellence in writing should secure a pass, unless the exercise is an intelligent reproduction of the story. The writing exercise prescribed for Standard V. may be altogether, and must be to a certain extent, an effort of memory: that for Standard VI. is the earliest exercise in composition required in the Code as part of the writing exercise; and no child ought to pass who does not show the power to put together in grammatical language, correctly expressed, and, if required, in the form of a letter, a few simple observations on some easy subject of common and familiar experience. In Standard VII. in order to warrant a pass the theme should exhibit something more of structural character and arrangement, the sense should be clear, the expressions fairly well chosen, and the writing, spelling, and grammar free from ordinary faults.

11. In all cases where a dictation exercise is given, the teacher may be permitted, if he desires, to read the passage over to the children before it is dictated by the inspector. In Welsh-speaking districts the teacher may be allowed to give out the whole of the dictation.

Arithmetic.

12. Little change has been made in Schedule I. in regard to the requirements under the head of Arithmetic. You will probably continue the usual practice of setting in all standards above the first, four sums, of which not more than one should be a problem, and of permitting a scholar to pass who has two correct answers. Right method and arrangement and good figures may excuse slight error in one of the answers. In Standard V. the 'rule of three by the method of unity' has been prescribed in order to avoid at that stage the difficulties of the theory of proportion, and to suggest a simpler method of solving ordinary problems by a combination of the four simple and compound rules. But if the answers are correct, and have been intelligently worked by either method, you will of course accept them.

13. Mental arithmetic is a new requirement, but is not intended to form an addition to the individual examination for the purpose of recording the 'passes' in the schedule. It is a class exercise, and may often be satisfactorily tested by requiring the teacher of the class to give a few questions in your presence, and by adding at discretion some questions of your own. The object of this exercise is to encourage dexterity, quickness and accuracy in dealing with figures, and to anticipate, by means of rapid and varied oral practice with small numbers, the longer problems which have afterwards to be worked out in writing. It is obvious that this general object cannot be attained if the exercises are confined to a few rules for computing 'dozens' and 'scores,' such as are often supposed to be specially suited for mental calculation. Practice should be given in all the ordinary processes of arithmetic; *e.g.*, in Standard I., addition, subtraction, and multiplication, with numbers up to 50 and money up to 2s.; in Standard II., all the four rules, with numbers up to 144, and with money to 10s.; in Standard III., easy reductions; and, in Standard IV., simple exercises in fractions founded on the multiplication table, and on the aliquot parts of £1, of a yard, and of a pound avoirdupois. It is often found a help in calculation if the dimensions of the schoolroom, the playground, and the desks, and the weight of a few familiar objects are accurately known and recorded, and occasionally referred to as standards of measurement.

Class Subjects.

14. In reporting on the subjects of grammar, geography, and history you have been required hitherto simply to state whether the whole grant ought to be awarded or disallowed. You will, in future, report whether a grant should be made, and, if so, whether the results of the instruction are 'fair' or 'good.' The mode of examining is left to your discretion, and may be usefully varied from year to year. It is often advisable to invite the teacher of the class to put a few questions in order that you may know what plan the has adoped before proceeding to propose questions of your own. In standards above the third the knowledge of the scholars may sometimes be tested by written answers, which you will carry home and examine; but you will generally be able to satisfy yourself by means of oral questions addressed separately to a sufficient number of the scholars, whether the class has been properly taught. The quality of the answers, as well as the number, will have to be considered, and the knowledge of the subject should be fairly distributed throughout the various standards. But, subject to these considerations, it is a safe general rule that the result may be marked 'good' when three-fourths of those examined are found to have been well taught, and 'fair' when one half of them prove to have been so taught. If this latter condition be not fulfilled, no grant should be recommended under Article 109 *f*.

15. Both in class and in specific subjects the Code permits a certain liberty of choice to managers, and it is no part of your duty to restrict this liberty. But if your advice is asked it will be well in giving it to have regard to the special qualifications of the teacher, and to the opportunities and means at hand for scientific or other instruction. Other conditions being equal, any teacher will be likely to teach best the particular subject of which he knows most, and in which he takes the strongest interest.

Grouping of Standards.

16. When the numbers in the upper division of the school as defined in Article 109 *f*. iii. do not exceed 30 at the beginning of the school year, the children of that division may be treated as one class for instruction in class-subjects. When the numbers exceed 30, the upper division should be divided into two groups at least. The grouping of standards is intended to work as follows:—Supposing the 4th and 5th Standards to form one group, and the 6th and 7th another, the former group will be required to take the work of the 4th and 5th Standards in alternate years, the latter that of the 6th and 7th standards in alternate years. If the four Standards—IV.-VII.—are placed in one group, they will take the subjects of each standard in turn.

English.

17. The examination in this subject is not, as you will observe, limited to technical grammar, although parsing and analysis still form an important part of the requirements. The general object of lessons in English should be to enlarge the learner's vocabulary, and to make him familiar with the meaning, the structure, the grammatical and logical relations, and the right use of words. Elementary exercises of this kind have an important practical bearing on everything else which a child learns. The recitation of a few verses of poetry has been prescribed in every standard, and it will be the duty of a teacher to submit to you for approval on the day of inspection a list of the pieces chosen for the ensuing year. It is not necessary that the required number of lines should be taken from one poem; they may be made up from two or more, provided that each extract learned by heart has a completeness and value of its own, and is understood in relation to the story or description of which it forms a part. The extracts should be simple enough to be pleasing and intelligible to children, yet in Standards III. and upwards sufficiently advanced to furnish material for thought and explanation, to improve the taste, and to add to the scholar's store of words. In testing the memory lesson it may suffice to call on a few of the children—

not less than one-fourth in each class—to recite each a few lines in succession, and occasionally it may be useful to require the verses to be written down from recollection.

18. From the first, the teaching of English should be supplemented by simple exercises in composition; *e.g.* when a word is defined, the scholar should be called on to use it in a sentence of his own; when a grammatical principle is explained, he should be asked to frame a sentence showing how it is to be applied; and examples of the way in which adjectives are formed from nouns, or nouns from verbs, by the addition of syllables, should be supplied or selected by the scholars themselves. Mere instruction in the terminology of grammar, unless followed up by practical exercises in the use of language, yields very unsatisfactory results.

Geography and Elementary Science.

19. The Code recognises as the means of instruction in geography and elementary science, reading books, oral lessons, and visible illustrations. But it does not prescribe the exact proportions in which these means shall be employed for each standard, and for each subject. Those proportions should be determined partly by the special plans and aptitude of the teacher, and partly by other considerations. In Standards I. and II. it will not be necessary for you to insist on the use of a reading book, if provision is made for meeting the requirements of the Code by a systematic course of collective lessons of which the heads are duly entered in the log-book. The best reading books for higher standards are those which are descriptive and explanatory, are well written and suitably illustrated, and contain a sufficient amount and variety of interesting matter. When these conditions are fulfilled, and the reading lessons are so supplemented by good oral teaching as to enable the scholars to pass the prescribed examination well, the requirements of the Code will be satisfied, even though the course of lessons in the reading book does not correspond in all respects to the year's work of a particular standard.

20. In teaching geography, good maps, both of the county and of the parish or immediate neighbourhood in which the school is situated, should be affixed to the walls, and the exact distances of a few near and familiar places should be known. It is useful to mark on the floor of the schoolroom the meridian line, in order that the points of the compass should be known in relation to the school itself, as well as on a map.

Singing.

21. The full grant for singing is not now to be claimed unless the scholars are so taught as to be able to 'sing by note.' You will be furnished in subsequent instructions with some simple testing exercises by which to determine whether this condition has been properly fulfilled. The regulations under which a grant has hitherto been given for singing will still apply in cases in which the children have been taught by ear only. A list of six or eight pieces should be presented, from which you will select one or more in order to judge whether the children have been 'satisfactorily taught' or not.

Needlework.

22. It will be seen that considerable reductions have been made in the amount of work required in needlework, and that the obligatory parts of Schedule III. now contain no more work than can be fairly mastered by any girls'-school in which four hours weekly have been devoted to this subject. If any school fails to earn the grant it will probably be found that such failure is due to bad teaching in the lower standards, or that the subject has not been taught (as all the other subjects are taught, and as needlework should be taught) to classes as well as to individuals.

23. No just progress can be made in the general teaching of needlework in a school without effective simultaneous teaching throughout the classes, and it will be the duty of the inspector specially to inquire into the needlework of infants, and of the lowest standards in other schools.

24. Where any uniform failure in the teaching of these classes occurs you will report, even when a grant is not claimed for needlework, that the subject is not properly taught; and it may be well to point out to the managers that a few specimens of garments from the best children do not compensate for imperfect teaching in the lower classes.

25. You will in all cases, as heretofore, examine the articles which the children have made during the year; and will satisfy yourself of the genuineness of the specimens by requiring some of the scholars to perform a simple exercise on the day of examination, whether a grant is claimed for needlework under Article 109*c*. or not. In order to ascertain that the teaching has been in accordance with the schedule, it will be needful to require a sufficient number of the scholars in two or more standards to work specimens of sewing or knitting in your presence. Detailed rules for the conduct of this part of the examination will be found in Appendix I. When needlework is selected as a class subject, you will not recommend the higher grant of 2s. unless the results of the teaching are clearly 'good.' The lower grant of 1s. may be obtained by the same degree of proficiency as will be required for the grant of 1s. under Article 109*c*.

Specific Subjects.

26. You will observe that specific subjects cannot be taken up before a scholar has passed the Fourth Standard; and that English, Geography, including Physical Geography, History, and Elementary science are recognised as class subjects. If these subjects are simply and thoroughly taught the scholars will form those habits of exact observation, reasoning, and statement which are needed for the intelligent conduct of life. In ordinary circumstances the scheme of elementary education, as now laid down by the Code, may be considered complete without the addition of specific subjects. It is not desirable, as a general rule, that specific subjects should be attempted where the staff of the school is small, or the scholars in Standards V.—VII. do not form a class large enough to justify the withdrawal of the principal teacher from the teaching of the rest of the school: in this latter case they would derive more benefit by being grouped with Standard IV. for class subjects. The pecuniary loss entailed by the exclusion of a few boys from the study of specific subjects will be abundantly compensated by the greater success in other subjects, and especially by the higher merit grant reserved for more thorough teaching generally.

27. In large schools, however, and those which are in favourable circumstances, the scholars of Standard V. and upwards may be encouraged to attempt one or more of the specific subjects, which the managers may deem most appropriate to the industrial and other needs of the district. It is not the intention of my lords to encourage a pretentious or unreal pursuit of higher studies, or to encroach in any way on the province of secondary education. The course suited to an elementary school is practically determined by the age limit of fourteen years; and may properly include whatever subjects can be effectively taught within that limit. It may be hoped that year by year a larger proportion of the children will remain in the elementary schools until the age of fourteen; and a scholar who has attended regularly and possesses fair ability may reasonably be expected to acquire in that time not only a good knowledge of reading, writing, and arithmetic, of English, and of Geography, but also enough of the rudiments of two higher subjects to furnish a stable foundation for further improvement either by his own exertion or in a secondary school.

28. In cases in which it is proposed to teach specific subjects, it will be desirable for you to ascertain that the teacher has given proof of his fitness to teach them by having acquitted himself creditably at a training college, or at some other public examination. You will often find that these subjects are most thoroughly taught when a special teacher is engaged by a group of schools to give instruction in such subjects once or twice a week, his teaching being supplemented in the intervals by the teachers of the school. You will judge of all schemes of elementary science which may be submitted to you for approval by their applicability to the school stay of the bulk of scholars, remembering that the whole course of study is primarily designed for those children who go to labour after they have reached the full time standard.

Merit Grant.

29. There is no graver or more difficult task imposed upon Her Majesty's Inspectors by the amended Code than that of assessing the merit grant. Your own experience must often have led you to conclude that the full value of a school's work is not accurately measured by the results of individual examination, as tabulated in a schedule; and that two schools, in which the ratio of 'passes' attained is the same, often differ materially in the quality of those passes, and in general efficiency as places of education. It is in order that these differences may be duly recognised in calculating the grant that my lords have caused the award of a substantial part of that sum to be dependent on the estimate you form of the merit of the school as a whole. Article 109*b*. specifies three particulars: (1) the organisation and discipline; (2) the intelligence employed in instruction; and (3) the general quality of the work, especially in the elementary subjects. Thus the award of the merit grant will be the result of several factors of judgment. The quality as well as the number of passes will necessarily rank as the most important of these factors; but inferences derived from them alone may be modified by taking into account the skill and spirit of the teaching, the neatness of

the schoolroom and its appliances, the accuracy and trustworthiness of the registers, the fitness of the classification in regard to age and capacity, the behaviour of the children, especially their honesty under examination, and the interest they evince in their work. The Code also instructs you to make reasonable allowance for 'special circumstances.' A shifting, scattered, very poor or ignorant population; any circumstance which makes regular attendance exceptionally difficult; failure of health, or unforeseen changes among the teaching staff, will necessarily and rightly affect your judgment. It is needful, however, in all such cases, to have regard not only to the existence of special difficulties, but also to the degree of success with which those difficulties have been overcome.

Schools not Entitled to Merit Grant.

30. From bad or unsatisfactory schools it is manifest that the merit grant should be withheld altogether. The cases which you dealt with under Article 32b. of the former Code, and in which a deduction of one or more tenths was made for 'faults of instruction or discipline,' or in which you have not recommended the grant for 'discipline and organisation,' would of course fall under this head. Other cases will occur which are not serious enough to justify actual deduction; but in which you observe that there is a preponderance of indifferent passes, preventible disorder, dulness or irregularity; or that the teacher is satisfied with a low standard of duty. To schools of this class no merit grant should be awarded.

Fair Schools.

But a school of humble aims, which passes only a moderately successful examination, may properly be designated 'Fair,' if its work is conscientiously done, and is sound as far as it goes; and if the school is free from any conspicuous fault.

Good Schools.

31. Generally, a school may be expected to receive the mark 'Good,' when both the number and the quality of the passes are satisfactory; when the scholars pass well in such class subjects as are taken up; and when the organisation, discipline, tone and general intelligence are such as to deserve commendation.

Excellent Schools.

32. It is the intention of their lordships that the mark 'Excellent' should be reserved for cases of distinguished merit. A thoroughly good school in favourable conditions is characterised by cheerful and yet exact discipline, maintained without harshness and without noisy demonstration of authority. Its premises are cleanly and well ordered; its time-table provides a proper variety of mental employment and of physical exercise; its organisation is such as to distribute the teaching power judiciously, and to secure for every scholar—whether he is likely to bring credit to the school by examination or not—a fair share of instruction and of attention. The teaching is animated and interesting, and yet thorough and accurate. The reading is fluent, careful, and expressive, and the children are helped by questioning and explanation to follow the meaning of what they read. Arithmetic is so taught as to enable the scholars not only to obtain correct answers to sums, but also to understand the reason of the processes employed. If higher subjects are attempted the lessons are not confined to memory work and to the learning of technical terms, but are designed to give a clear knowledge of facts, and to train the learner in the practice of thinking and observing. Besides fulfilling these conditions, which are all expressed or implied in the Code, such a school seeks by other means to be of service to the children who attend it. It provides for the upper classes a regular system of home exercises, and arrangements for correcting them expeditiously and thoroughly. Where circumstances permit, it has also it lending library, its savings bank, and an orderly collection of simple objects, and apparatus adapted to illustrate the school lessons, and formed in part by the co-operation of the scholars themselves. Above all, its teaching and discipline are such as to exert a right influence on the manners, the conduct, and the character of the children, to awaken in them a love of reading, and such an interest in their own mental improvement as may reasonably be expected to last beyond the period of school life.*

33. It is hardly to be expected that any one school will completely satisfy all these conditions, and it is impossible that in the course of a single visit of inspection your attention should be directed to so many particulars. But it will be well to keep all of them in view in forming your own standard of what the best schools should aim at; and my lords do not wish the mark 'Excellent' to be given to any school which falls short of that standard in any important respects, or which is not, in some of them at least, entitled to special praise.

34. The responsibility of recommending the merit grant will in every case rest upon the inspector, and should not be delegated to an assistant. My lords do not require that you should state in fuller detail than you think desirable in your report on a school your reason for designating it as 'Fair,' 'Good,' or 'Excellent;' but in all cases in which you recommend that the grant should be withheld, the grounds on which you do so should be briefly stated for the information and guidance of the managers.

Punishments.

35. My lords regret to receive frequent complaints of the excessive use of corporal punishment in schools, and of its occasional infliction by assistants and pupil-teachers, and even by managers. The subject is one on which your own observation is necessarily incomplete, since children are not likely to be punished in your presence on the day of inspection. But you will not fail in your intercourse with teachers and managers to impress upon them that the more thoroughly a teacher is qualified for his position by skill, character, and personal influence, the less necessary it is for him to resort to corporal chastisement at all. When, however, the necessity arises, the punishment should be administered by the head-teacher, and an entry of the fact should, in their lordships' opinion, be made in the log-book.

Registration.

36. In view of the fact that the grant made to a school is mainly calculated on the average attendance, accurate registration of admission, progress, and attendance continues to be of essential importance, and will require special care on the part of managers and watchfulness on your own. In Appendix II. you will find a revised edition of the official rules, which have been long in force for the proper keeping of registers, and it will be well to call the special attention of managers and teachers, especially in new schools, to the details set forth in that Appendix.

Irregularity of Attendance.

37. It must be clearly understood that irregularity of attendance, unless it is produced by some of the causes which constitute a reasonable excuse for absence, cannot be accepted as an excuse for the want of progress of any scholar. It has now become the interest of all concerned in the pecuniary results of the annual examination to increase the average yearly attendance by diminishing daily irregularities; but it may be hoped that higher motives will prompt all interested in education to press upon those entrusted with the execution of the law the actual legal obligation by which all parents are bound to present their children at the beginning of each meeting of the school. Cases of gross neglect on the part of the authorities, if brought to your notice, should form the subject of a special report to the Department. In your general judgment of the school, you will be careful to make allowances for all such neglect if the managers and teachers cannot be held responsible for it.

Excuses for Non-attendance on the Day of Examination.

38. The Code requires—

I. That all scholars whose names are on the registers of the school must be present at the inspection, unless there is a reasonable excuse for their absence.

II. That all such scholars whose names have at the end of the school year been on the register for the last 22 weeks during which the school has been open must be presented to the inspector for examination.

39. Hitherto, since part of the grant was based upon the individual payment for the successful examination of all scholars who had attended 250 times in the course of the year, managers were interested in getting together all such scholars on the day of inspection. As the grant is now based upon the average attendance of all the scholars, and will be adversely affected by the failure in examination of backward scholars, it will be your duty to see that every child who is liable to be presented for

* Your attention may be usefully recalled to the following extract from the Code of 1881:—

'The inspector will bear in mind, in reporting on the organisation and discipline, the results of any visits without notice made in the course of the school year; and will not interfere with any method of organisation adopted in a training college under inspection if it is satisfactorily carried out in the school. To meet the requirements respecting discipline, the managers and teachers will be expected to satisfy the inspector that all reasonable care is taken, in the ordinary management of the school, to bring up the children in habits of punctuality, of good manners and language, of cleanliness and neatness, and also to impress upon the children the importance of cheerful obedience to duty, of consideration and respect for others, and of honour and truthfulness in word and act.'

examination is present, unless there is a reasonable excuse on the day of examination, and to record the absent scholars on the schedule as if they had been present and had failed. If the number of absentees be large, the absences should be a positive disqualification for the mark 'good' or 'excellent' in assessing the merit grant. Among reasonable excuses, probably the most general will be found to be infectious disease in the home, storms, unavoidable absence from home, a death in the family, or the scholar's having left the neighbourhood. Beyond these it is not probable that many reasonable excuses will be found, though cases of an exceptional character may arise, and can only be decided on the day of inspection.

Withholding Children from Examination.

40. Many well-founded complaints have been made of undue pressure on backward scholars by keeping them in after school, by long home lessons, or by an injudicious use of emulation. The fact that a reasonable allowance may now be made for exceptional cases under Article 109c iii. will, it may be hoped, diminish this evil. Irregularity of attendance cannot be considered as a valid reason for withholding a child from examination, and managers of schools should refuse to countenance this plea, and should co-operate with all concerned in promoting greater regularity of attendance. The following excuses may, however, be reasonably accepted for withholding a scholar:—Delicate health or prolonged illness; obvious dulness or defective intellect; temporary deprivation, by accident or otherwise, of the use of eye or hand. But in order that all scholars whom it is proposed to withhold may not be neglected by a teacher, it will be your duty to look carefully through the list of such scholars, and to form a personal judgment as to the reasonableness of the excuses.

Re-presentation in the same Standard.

41. As a general rule, all scholars who have failed at the previous examination in any standard in two subjects may be presented a second time in that standard. The fact of such failure can be attested in the case of scholars who were in the school at the previous examination by means of last year's schedule, which will be before you. In the case of children coming from other schools, there may be difficulty in obtaining evidence of the highest standard previously passed; but, as a general rule, it should be presumed that such children, if above ten years of age, have passed Standard III., and all exceptions to this rule should be held to require explanation.

Cookery.

42. In all schools the grant for cookery, § 109 (*g.*) ix., should be conditional on the provision of special, adequate, and suitable arrangements for the practical instruction of the girls by a duly qualified teacher, in a room (which may be an ordinary class-room) fitted up with the necessary appliances. In schools, the circumstances of which admit of it, demonstration lessons in cookery should be given at frequent intervals by a professional person.

Pupil Teachers.

43. It is a fact deplored by all connected with the examination of candidates for admission to training colleges, and by all who have to instruct our future teachers in these colleges, that many pupil-teachers, at the close of their engagements, should possess so scanty a knowledge of arithmetic, geography, grammar, and history. Unless it is supposed that the great bulk of their teachers have neglected their instruction, the school work must obviously have pressed so heavily upon these young persons as to leave very little time for their improvement. It is admitted that boys and girls of sixteen or seventeen years of age should not spend more than eight hours daily in intellectual labour, and it cannot be thought an unnecessary requirement that out of this weekly maximum of forty hours (allowing for two half-holidays), ten hours should be reserved for the private studies of the pupil-teachers, over and above the five hours already prescribed for their instruction or examination by the teacher of the school. The new form of Memorandum of agreement (Schedule VI.) requires no more than twenty-five hours per week of actual service in teaching. When the work of the school is carried on for more than twenty-five hours, the time-table should be so arranged as to give the pupil-teacher the remaining time for private study in the school or class-room under the direction of the head-teacher. In this way the necessary work of preparing lessons out of school hours may be somewhat reduced,

Evening Schools.

44. Article 113 has been designed to encourage more advanced and varied teaching in the evening school, and at the same time to indicate clearly its character as a supplement to the day school rather than as a substitute for it. It may be hoped that ere long no scholar will leave the day school for labour who has not passed the full-time standard; but exceptional cases will arise in which a night scholar may not have reached this standard, or, having reached it, may have forgotten much of what he has learned, and may require to go back and recapitulate. For such cases the Code provides that examination may be as low as Standard III.; and there need be no objection, when a scholar has for some time been employed, to allowing him to repeat the examination for the last standard which he has previously passed. In all such cases satisfactory explanation should be furnished by the managers. If in any instance it is proposed to put a scholar back two standards, sufficient reasons should be assigned. The managers should take reasonable pains to procure evidence at each scholar's admission of the standard in which he has previously been presented, and of the standard for which he is fitted.

45. In framing the Code my lords have desired—while retaining as of prime importance the individual examination in reading, writing, and arithmetic—to give greater freedom of choice to good teachers in regard to other subjects, to attach increased weight to intelligence and to the quality of instruction, and to bring the mode of computing the grant into closer correspondence with the various conditions which determine the efficiency of the school. The full attainment of these objects depends largely on your personal exertions and influence, and on the spirit in which you co-operate with the best efforts of voluntary managers, School Boards, and other local bodies interested in promoting education. Their lordships are aware that some of the new duties which are imposed upon you by the Code of 1882 are delicate and onerous, and will call for the exercise, in a higher degree than ever, of carefulness, insight, and sympathy. But they rely with much confidence on the discretion, and ability of Her Majesty's inspectors, and on their willingness to give effect to any measure designed to improve the character of elementary schools, and to increase the public usefulness of the Education Department.

I have the honour to be, Sir,
Your obedient servant,
F. R. SANDFORD.

APPENDIX I.

EXAMINATION IN NEEDLEWORK (Schedule III.).

1. At least forty-five minutes should be given to this examination.

2. A table of exercises, to be worked in this time, is annexed. The material required for each is shown.

3. It is desirable that as a rule, and when the numbers in the standards to be examined are sufficiently large, the whole of the exercises should be given. You should therefore, as far as may be practicable, divide the scholars in each standard examined into as many groups (A, B, C, etc.) as there are exercises to be performed, and assign one exercise to the children of each group. Thus, for example, Standard IV. would be divided into five groups, and each of the five exercises would be worked in one of the groups.

4. Suitable needles, cotton, thimbles, and scissors, if not given out beforehand, should be in readiness for distribution with the other materials, so that time may not be lost at the examination. Each girl should fasten securely together the different specimens if the exercise include more than one.

5. If the specimens are taken away for examination, it is desirable that at the close of the time allotted each child's work should be folded separately, the exercises in each group tied together, and the whole made up in standards, and fastened up, with the name of the school outside.

6. Coloured cottons are recommended throughout. The object of giving two colours is to test the children's knowledge of 'joinings'; this must be attended to in all cases.

7. Great attention should be paid to evidence of carefulness in teaching 'joinings,' and 'fastenings' on and off, and to general neatness of finish.

8. In cutting out, more credit should be given to correct proportions, and useful intelligent work, than to elaborate or trimmed paper models. This applies more particularly to the cutting out that may be shown as part of the work of the year.

9. It is of great importance that teachers of all grades should give evidence of their power of teaching needlework by demonstration and by simultaneous method. You should therefore, whenever practicable, call upon one or more of the pupil-teachers and assistant-teachers in each school, and especially the certificated assistants, to give an oral lesson in your presence.

10. In infants' classes the children, including those who are too young to work exercises, should be prepared to go through the movements of needle position and knitting pin drill in your presence.

APPENDIX II.

REGISTRATION.

1. The Code requires that before any grant is made to a school the Education Department must be satisfied that suitable registers are provided, accurately kept, and periodically verified by the managers (Articles 8 and 96*c*), and again under Article 115 the grant may be reduced upon the inspector's report for faults of registration.

2. In every school there should be (1) a register of admission, progress, and withdrawal; (2) registers of daily attendance for all scholars; (3) a book of summaries. These registers must (Article 8) be provided by the managers out of the funds of the school, so as to be the property of the school, and not in any sense of the teacher.

Admission Register.

3. The *Admission Register* should be kept exclusively by the head-teacher, and made up at least once a week. Successive numbers should be allotted to the children on their admission, so that each child may have its own number, which it should retain throughout its school career. A child who returns to school after an absence of any duration would resume its original admission number. The name need not be re-entered in the Admission Book if the child is re-admitted in the course of one school year.

4. No child's name should be removed from the register on account of absence for any period less than six weeks (except in case of death), unless the managers have ascertained, or the school attendance officer reports, that the child has left the school or neighbourhood.

5. This register should show distinctly for each child in the school (*a*) its number on the register; (*b*) the date of its admission or re-admission, day, month, and year; (*c*) name in *full*, christian and surname; (*d*) the name and address of its parent or guardian; (*e*) whether exemption from religious instruction is claimed; *(*f*) the exact date of the child's birth, day, month, and year; *(*g*) the last school (if any) which it attended before entering this school; *(*h*) the highest standard in which it was there presented; (*i*) the successive standards in which presented in *this* school; (*k*) the date of leaving.

6. Where several children of the same name attend, they may be distinguished thus:—"John Jones (*a*)," "John Jones (*b*)," etc.

7. This register should have an alphabetical index.

Attendance Register.

8. *The attendance registers* must *be marked every time that the school meets*, however small the number of children present, and all attendances so marked must be taken into account. They should show the daily and weekly attendances of every scholar, beginning with the first day of the school year (Article 22), and continuing to the end of the same.

9. Adequate time for marking these registers should be provided for in the time-tables—from five to ten minutes or more—according to the number of scholars.

10. In mixed schools the boys should be entered in the upper part of a page, the girls in the lower, leaving a space between them.

11. On the outside of the cover of each register should be legibly written the name of the school and the year, also the department (boys', girls', mixed, or infants', as the case may be), and the class or classes to which it belongs. All registers should be paged.

12. There should be columns for each child's admission number, for its name in full, and its age last birthday, and columns for all the weeks in the year, which should always be dated at their head with the day and the month. One also for the morning attendances and another for the afternoon attendances of every day, with a place at their foot for adding them up. A column for school pence received in each week is not unfrequently added to the attendance columns; but as this is apt to cause confusion in the additions, both of the pence and of the attendances, the pence columns had better be kept separate, unless entries be made in them in red ink. There should be a column for the entry, at the close of each week, of the total attendances made by each child during that week, and at the end of the register columns, to sum up the total attendances of each child during the year. The Code requires a separate register for half-timers. The register for each class may be marked by the pupil-teacher (if he have completed his second year) having charge of the class; but the head-teacher will be held responsible for its being regularly and properly kept.

13. In marking the attendance registers the following rules should be observed:—(1) The registers must be marked, and, excepting marks cancelled under 10 *infrà*, be finally closed at least two hours before the termination of the time given to the secular instruction at each meeting of the school, and at the time specified on the approved time-table; (2) after the registers are closed no child may be marked; (3) children must be marked at each meeting of the school; (4) in ink, never in pencil inked over afterwards; (5) presence must be marked with a long stroke, thus, /, or \; (6) absence must be marked with an 'a'; (7) there must be no dots; (8) no erasures—if any error has been made it must be corrected by a footnote; (9) no blanks; (10) if a child leaves before the two hours of secular instruction expire, its mark for presence should be cancelled by another stroke across it, thus ×, and the total attendances for that meeting corrected by placing under them —1, —2, as the case may be; (11) registers must be original, and not copied from slates, papers, etc., on pretence of keeping them clean, or any other plea; (12) the number of attendances made by the class should be entered at the foot of the column every morning and afternoon at the time of closing the registers; (13) the number of attendances made by each child during the week must be entered; (14) when a half or whole holiday occurs, or on the occasion of days set apart for special inspection, under section 76 of the Education Act (when the meetings and attendances are *not* to be registered for the purpose of annual grants), a line should be drawn down the whole length of the column or columns; (15) for longer periods 'holiday' should be written across the columns.

14. At the foot of the attendance columns for each week, or in some place specially provided for them in the registers, should be entered: (*a*) the number of times the school was open, morning and afternoon; (*b*) the total number of attendances made by all the children on this register during the week.

15. At the foot of each pence column the total amount of pence received during the week.

Summary.

16. The *Summary* should contain (1) the weekly entries of the attendance of each class transferred from the class registers every week into appropriate pages, and the average attendance for each week; (2) at the completion of the year the annual averages for the whole school should be struck and entered of boys and girls separately—(1) under 3, (2) between 3 and 7, (3) above 7, and (4) above 8, and the highest weekly average noted; (5) the summary should be clear, and should at once show the results asked for in the Managers' Return (Form IX.)

17. In this book the duplicate examination schedules, and copies of the returns in Form IX., should be preserved, together with a list of scholars qualified to be presented, but not presented, with the reasons for their not being presented, and likewise of scholars presented a second time in the same standard, with the reasons for their being so presented.

18. The Managers' Return (Form IX.) will contain a certificate that the registers have been checked at irregular intervals, and at least once in every quarter, by the managers. To check the registers, the managers, or some one deputed by them, should visit the school, without previous notice, after the registers ought to be closed, and ascertain that the number of attendances marked tallies exactly with the number of children then present. An entry should also be made in the log-book and in the registers at the time of checking them; they should also be signed at the same time by the teachers responsible for them.

19. *The managers' return should show, by separate entries, the number of admissions and re-admissions in the course of the first and second halves of the school year respectively.*

20. *Attendance* registers, when filled, should be put away and preserved for at least *ten* years. Admission registers and summaries should never be destroyed.

21. The above rules are intended for day schools, but should be applied as far as possible to evening schools.

22. My lords do not at present insist upon uniform registers as a condition of annual grants, but they trust that by the co-operation of the managers of schools such an extent of uniformity may be gradually introduced as to make the adoption hereafter of a uniform system of registers a matter of little difficulty.

* Special care must be taken to obtain exact information on these points from the parents, former teachers, and registrar of births, if necessary.

In the following Table the requirements of the Code for each Standard are divided into groups of moderate length, any one of which may be given by the Inspector in their respective Standards.

Lower Division of Infants.	Upper Division of Infants.	Standard I.	Standard II.	Standard III.	Standard IV.	Standard V.	Standards VI. and VII.
A.—To hem 5 ins. in one colour. B.—To knit 6 rows of 12 loops previously cast on.	A.—To hem 5 inches in two colours so as to show a join. B.—To cast on 12 loops and knit 12 rows. **O.—To fix and work a hem of 5 inches in one colour.*	A.—To fix and work in two colours a length of 7 inches, and fix and work the two corners. B.—To cast on 20 loops, knit 20 rows with chain edge, and cast off. C.—To fix and work a sew and fell seam of 7 inches. **O.—To fix and work a seam of 7 inches and then fix 4 pleats in the joined material.*	A.—To fix and seam together two pieces in two colours and hem round the four sides. B.—To cast on 20 loops and knit 20 rows, ribbed, pearl, and plain, breaking and joining the wool at least once in the space; afterwards cast off. C.—To fix and work in two colours a sew and fell seam of 7 inches, using two colours in both seam and fell. **O.—To pleat 7 inches into at least 6 pleats, and hem it into a band of 3 inches.*	A.—To prepare for stitching, and stitch at least half of a piece 7 inches long in two colours, and to sew on a string. B.—To cast on 40 loops and knit with 4 pins 15 rows, breaking and joining the wool at least once in the space; afterwards cast off. C.—To herring-bone down the four sides of a piece of flannel about 4 inches square. D.—To darn 10 rows 1½ inch long on cheese cloth or calico, and mark on the same material two letters out of the first six of the alphabet. These letters may be the same for the whole of the group.	A.—To gather and stroke down 7 inches, and set into a band of 3 inches. B.—To put in a flannel patch about 2 inches square, and darn 10 rows 1 inch long on the same material. C.—To cast on 31 loops and make the heel of a stocking, turn it, and cast off. D.—To double down and tack a piece of calico, and on this cut and work two buttonholes—one with both ends round, the other with both braced—and sew on a linen button. E.—To mark on calico two letters chosen by the inspector, and to darn an irregular space about 1 (square) inch on stocking web material.	A.—To turn down and tack a hem ½ inch wide, and on this cut and work a buttonhole with one end round and the other braced, run two tucks 7 inches long, and sew on a linen button. B.—To put in a calico patch about 2 inches square, and mark on the patch one of own initials. C.—To cast on 20 loops, and knit with 2 pins 40 rows showing seam stitch and three decreasings on each side as for the back of a stocking. D.—To cut out and tack together pattern of pinafore, to plain darn a hole ½ inch square on stocking web material. E.—To sew and fell 2 inches of pieces 7 inches long and put in gusset as for body of shirt and stitch it across.	A.—To cut out and tack together pattern of girl's shift, also to graft 3 inches and to take up a ladder. B.—To darn calico on a diagonal cut ½ inch long. C.—To darn an irregular space of about 2 square inches on some dress material, and to put in a patch about 2 inches square on same material. D.—To cast on 40 loops, knit 5 rows with 4 pins, divide and knit a thickened heel, turn it, and pick up the gusset and cast off. E.—To hem and whip 6 inches of frill and set on to calico band, and mark on the band one of own initials. **O.—To Swiss darn a space 1 inch square, and on a calico hem ¾ inch wide, do 2 inches of knotting, and 2 inches of coral stitch.*
MATERIALS REQUIRED FOR THE EXERCISES IN EACH OF THE ABOVE GROUPS. N.B.—It is desirable to use 'Betweens' for sewing needles, short pins for knitting, and fine cotton generally throughout the Standards.							
A.—A piece of calico 5 inches by 2, fixed for hemming, and coloured cotton. B.—A pair of knitting pins, with 12 loops cast on, and cotton.	A.—A piece of calico, 5 inches by 2, fixed for hemming, and cotton of two colours. B.—A pair of knitting pins and cotton or wool. †*O.—A piece of calico 5 inches by 2, and coloured cotton.*	A.—A piece of calico 7 inches by 3½, and cotton of two colours. B.—A pair of knitting pins and cotton or wool. C.—Two pieces of calico 7 inches by 3½, and coloured cotton. *O.—Two pieces of calico 7 inches by 3½, and coloured cotton.*	A.—A piece of calico 7 inches by 3½, and cotton of two colours. B.—A pair of knitting pins and wool. C.—Two pieces of calico 7 inches by 3½, and coloured cotton of two colours. *O.—A piece of calico 7 inches square, and a piece 3½ inches square.*	A.—A piece of calico 7 inches by 3½, about 2 inches of tape, and cotton of two colours. B.—A set of knitting pins and wool. C.—A piece of flannel 4½ inches square. D.—A piece of cheese cloth or calico 4½ inches square.	A.—A piece of calico 7 inches square, and a piece 3½ inches square. B.—A piece of flannel 4½ ins. square, and a piece 2½ ins. square. C.—A pair of knitting pins and wool. D.—A piece of calico 3½ inches square, and a linen button not pierced. E.—A piece of calico 3½ inches square, and a piece of stocking web 3 inches by 4.	A.—A piece of calico 7 inches square, and a linen button not pierced. B.—A piece of calico 7 inches square, and a piece 3½ inches square. C.—A set of knitting pins and wool. D.—A sheet of tissue or lined paper about a yard square. A piece of stocking web 3 inches by 4. E.—Two pieces of calico 7 inches by 3½, and a piece 3½ inches square.	A.—A sheet of tissue or lined paper about a yard and a quarter by a yard wide. Also two pieces of stocking web, 3 inches by 4, one of them with a ladder an inch long. B.—A piece of calico 3½ inches square. C.—A piece of dress material 7 inches square and a piece 3½ inches square. D.—A set of knitting pins and wool. E.—A piece of mull muslin 6 inches by 1, and a piece of calico 3½ inches square. *O.—A piece of stocking web 3 inches by 2, and a piece of calico 7 inches by 3½.*

* Exercise *O* is optional. † The material required for each group should be carefully prepared and arranged beforehand, so that time may not be lost at the examination. The quantity provided should be in excess of what is likely to be used.

*** Art. 109 (f.) has been amended by the omission in (i.) 5, of the words, '*in mixed schools*'; so that Needlework may now be taken as a second 'class' subject by Girls in any School.

Syllabus of Exercises for Pupil-Teachers on the day of Annual Examination.

First Year.	Second Year.	Third Year.	Fourth Year.
First Exercise. Join two pieces of calico together by seam and fell. Gather, stroke, and set in one joined end into a band. Hem the bottom, sew on a tape-string.	**First Exercise.** Make a band with calico, on it work a button-hole, set on a button, and hem, whip, and set on a frill.	**First Exercise.** Put in a patch in print about 3 inches square. Draw a letter, chosen by the inspector, in pencil on the patch, and work it out in stitching.	**First Exercise.** Join two pieces of calico half their length, and insert a gusset, as for the body of a shirt, and stitch it across. Also work at least two inches of coral stitch, and mark one figure chosen by the inspector.
Second Exercise. Cast on 39 loops, and with two pins knit a piece as if for the calf of a stocking showing three decreasings, and cast off.	**Second Exercise.** Fold down a hem on calico, on it work a button-hole with different ends, and run at least two tucks, and mark one letter chosen by the inspector.	**Second Exercise.** Set in a triangular patch in flannel about 3 inches each way; on it darn 10 rows as for a thin place.	**Second Exercise.** On a stitched band work a button-hole as for the left side of a shirt-front, and another as for the back of an infant's robe. Sew on a tape string and a button.
	Third Exercise. Cast on 40 loops, knit and purl 4 and 4 for 4 rows, then alternate the squares to form a chequer three times, and cast off.	**Third Exercise.** Cast on 51 loops, knit a thickened heel, turn it 'Dutch' shape, and cast off.	**Third Exercise.** Set in a calico patch about 3 inches square, and mark one letter and one figure chosen by the inspector. **Fourth Exercise.** Cast on 40 loops, and with 4 pins make the toe of a sock.

Materials required for the above Exercises.

First Exercise 1 piece of calico 3½ by 3½ inches. 2 pieces of calico 7 by 3½ inches. 1 piece of tape 2½ inches long. 6 yards sewing cotton. 2 sewing needles. **Second Exercise.** 2 knitting pins. 10 rounds of a skein of wool or cotton.	**First Exercise.** 1 piece of calico, 7 by 3½ inches. 1 piece of mull, 1 by 6 inches. 1 linen unpierced button. 6 yards sewing cotton. 2 sewing needles. **Second Exercise.** 1 piece of calico 7 by 7 inches. 2 sewing needles. 6 yards sewing cotton. 1 yard marking cotton. **Third Exercise.** 4 knitting pins. 10 rounds of a skein of wool or cotton.	**First Exercise.** 1 piece of print, 9 by 9 inches. 6 yards of sewing cotton 2 sewing needles. **Second Exercise.** 1 piece of flannel, 9 by 9 inches. 2 sewing needles. 6 yards sewing cotton. 2 yards darning cotton. 1 darning needle. 1 yard marking or common coloured cotton. **Third Exercise.** 2 knitting pins. 10 rounds of a skein of wool or cotton.	**First Exercise.** 1 piece of calico, 3½ by 3½ inches. 2 pieces of calico, 7 by 3½ inches. 6 yards sewing cotton. 2 sewing needles. 1 yard marking cotton. **Second Exercise.** 1 piece of calico, 7 by 3½ inches. 1 linen unpierced button. 1 piece of tape 2½ inches long. 2 sewing needles. 6 yards sewing cotton. **Third Exercise.** 1 piece of calico, 7 by 7 inches. 1 piece of calico, 3½ by 3½ inches. 2 sewing needles. 6 yards sewing cotton. 1 yard marking cotton. **Fourth Exercise.** 4 knitting pins. 20 rounds of a skein of wool or cotton

N.B.—It is optional to the inspector to choose which of the above exercises shall be done in his presence.
Fine needles (Betweens), with fine cotton, No. 16 knitting pins, and No. 10 knitting cotton or 'fingering' yarn are recommended throughout.
The sizes of the pieces are given to show the amount necessary. Larger pieces can be used if desired.

Publications Reviewed.

*** We are sorry to disappoint the many friends who desire us to quote the price of each work noticed in our columns. This we would respectfully point out is the publishers' duty and not ours; we give publicity enough to a book when we review it. Our readers should peruse the advertisements in our pages, and failing to find the price here, it would be no great trouble or expense to drop a line to the publishers, whose name and address we will gladly give.

History of Shorthand. By Thomas Anderson. London: W. H. Allen and Co., Waterloo Place.

In reading some passages in this book it would appear to be impossible for the utterances of a tolerably rapid speaker to be taken down with anything like verbal accuracy, and that confusion must occur in 'words nearly alike in sound,' as the old spelling books have it. Further, that Odell's recommendation to 'dash with the pen, take down the very words,' which we read in the little book he published some half-century ago, was a sheer impossibility. How far a clever reporter trusts to his memory when his hand 'forgets its cunning' is, we fancy, yet open to dispute. But notwithstanding the apparent intricacy of the art and the apparent difficulties in the way of decyphering the symbols, the fact remains that by aid of these dots, dashes, and curves—we hope we may be permitted to say 'by hook or by crook'—speeches are taken down with an astonishing approach to accuracy. We had the pleasure of listening to a sermon in company with the veteran stenographer, Mr. F. Pitman, and of hearing this gentleman read, for our edification, an extract from the said sermon, and which astonished us by the marvellous accuracy with which—to the best of our recollection—every word was reproduced! We mention this to account in some way for the popularity of Pitman's system, which Mr. Anderson is disposed to criticise if not condemn as being connected with the Quixotic attempt to revolutionize in the desire of reforming our orthography. Of course, the judgment of professors, or, at least, experts in reporting, is requisite to decide upon the comparative merits of different systems, and even then each system is naturally enough defended by those who acquire dexterity therein. But amid all this contention—for this by-path of literature seems to be trodden by vivacious disputants—the student as well as the general reader will find the whole history of the art detailed in Mr. Anderson's pages, with interesting information of the early attempts of the Greeks and Romans in the same field. Short notices of the state of the art among the principal European nations, and also among the Americans, are also given. Mr. Anderson regards Gurney's abbreviations as certain, though numerous and lacking comprehensiveness, while Gabelsberger's are comprehensive though somewhat uncertain. Pitman's he regards as numerous, arbitrary, and not always sure. Further, he regards

Gurney's as the best representative of legibility, Gabelsberger's of ease, and Taylor's of rapidity. Pitman's he regards briefer than all others, but thinks this brevity compassed at too great a cost in the way of accuracy. Doubtless in this art progress is altogether disconnected with such happy discoveries as reward the scientific experimenter. Though the stenographer or phonographer has to work his way by laborious effort, yet the improvements in the past justify hope of more success in the future.

Mensuration for Beginners. Part I. Mensuration of Plane Surfaces. By William Dodds. London: Murby.

This book would have been more appropriately named 'The Beginning of Mensuration,' as it comprises squares, rectilinear figures, and plane triangles only, and stops short of circles. So far as it goes, however, the book is useful, and the examples varied and well chosen. Most of the rules are accompanied by a geometrical demonstration excepting the finding of the area of a triangle from the data of three given sides. This is not easily demonstrated it is true, except by trigonometrical formulæ, but may be accompanied with an algebraical elucidation, such, for instance, as that given by old Bonnycastle. The arcana of links, chains, and acres, grievously puzzling to beginners, are here fairly explained.

Readings in English History. For the Upper Classes in Schools. London: Thomas Murby.

This compilation is formed of extracts from several popular historians, including Macaulay, Hume, Carlyle, Bancroft, Greene, Motley, together with sketches from Dickens, Hepworth Dixon, Howitt, and Gairdner in the way of prose, and several poetical extracts from Shakspere, Scott, Wordsworth, and Southey. To several of the chapters explanatory notes are appended, which will greatly facilitate the appreciation and understanding of difficult words and allusions among youthful readers.

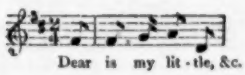
Locke on Words. (*Locke's Book III. on the Essay Concerning the Human Understanding.*) By F. Ryland, M.A. London: Swan Sonnenschein.

It needs no commendatory remarks to acquaint all well-informed readers of Locke's merits, nor of the clearness with which his truths are conveyed. Among the parts of his invaluable treatise this (Book III.) on *Words* is of especial value to those engaged in teaching. The edition before us is supplemented by a series of valuable notes by Mr. Ryland, of great use to the student, and most interesting to the general reader. The severe blows dealt to the schoolmen in the seventeenth century by Bruno, Bacon, Descartes, Gassendi, and Hobbes, evidently influenced Locke to express disapprobation for mere catch-words—in which the schoolmen often indulged—without perhaps recognising the acuteness and clearness with which the disciples of Aristotle carried on their wordy warfare. So far as intellectual culture was concerned the scholastics were useful, but by yielding to the influence of terms, which Locke condemns, they were drawn from the patient investigation of phenomena which is content with nothing short of demonstration. The schoolmen have been erroneously accused of neglecting observation; but the truth is that their observation was so mixed with mere verbalisms as to be in many cases unreliable and delusive. The old phrases of *Nature abhors a vacuum*, and the *spontaneous mobility of atoms* (*ab intrinseco propulsio*) are brought forward by Mr. Ryland with references to the best modern authorities thereon. Altogether the book is a praiseworthy and scholarly attempt to popularize, and, where needful, explain this 'immortal Third Book' of Locke's Essay.

The Day-School Song-Book. By A. Johnson. London: Bemrose and Sons.

These songs are too full of defects both in music and poetry to become popular. The music in very many cases violates propriety of accent, as in Longfellow's 'Village Blacksmith' we have—

Mr. Rogers' beautiful lines are similarly murdered by wrong accent, thus:—



In other respects the music is varied from the baldest simplicity of an eight-bar tune, 'Pretty Pussy,' to the 'Song of the Smiths,' of nearly fifty bars, which opens thus, and with the chord of $\frac{6}{4}$—objectionable from being unresolved—at the end of the second bar:—

In regard to the words, we are told that the whale

'Measures seventy feet in length;
His tail is four-and-twenty broad;
And when he strikes, with its great strength
He scatters boats and crews abroad.'

After this bit of figurative writing we are introduced to the loving nature of the whale:—

'With deep affection he is blest,
This creature of such wondrous size:
He clasps his offspring to his breast
When wounded, and, to shield it, dies.'

After this gush of paternal affection we are told that—

'When dead, and he no longer feels
The pain, his teeth for bone they take,
And tons of oil his blubber yields
To oil machines and candles make.'

So that boys and girls are reconciled to the capture of the whale notwithstanding the gushing affection of the huge animal on account of the blubber and oil for machines and candles. Boys will simply laugh at such stuff as this!

The writer of the words—we dare not call it poetry—seems fond of *figurative* details: for example, he tells us about the hippopotamus that—

'His bulk, from tail to snout,
Is seventeen feet along:
His jaws he opens two feet wide;
His teeth are one foot long.'

We have not time to notice many grammatical defects, such as the omission of 3rds in the harmony that mark several passages of the music.

English Grammar. Parts I. to VI. for Standards II. to VII. By Thomas Morrison. London and Edinburgh: Gall and Inglis.

The gradation of lessons enforced by the code will bear good fruit in securing a wise avoidance of the more difficult branches of various subjects for the early standards and the concentration of the attention of pupils of the advanced standards on the higher matters of each subject. Hitherto teachers have not known how far to go, and have in many cases unwisely attempted too much. The very term grammar is so comprehensive as to be practically vague, unless circumscribed and graded for each code.

The numbers forming the series before us are generally well arranged according to the code requirements, and with some few exceptions accurately written. One of these exceptions is in the treatment of the subjunctive mood in Standard II. Mr. Morrison tells us (p. 32, part i.) that 'A verb is said to be in the subjunctive mood when it implies doubt or a supposition.' This is preceded by the example, '*If John strikes the table*, I don't state a fact, but make a supposition.' And, further, this is again defined in the summary (p. 48) thus:—'A verb is in the subjunctive mood when it implies doubt or uncertainty.' Not so. To *doubt* must be added *futurity* or the verb is not truly in the subjunctive. The auxiliary *should* will help us to determine the subjunctive, and we say 'If John should strike the table' in full, or without the guiding *should* 'If John strike the table,' but the element of futurity must be borne in mind as well as that of doubt to ensure the true form of the subjunctive; we may be in doubt about the weather, and say, 'If it rains, go out,' and herein we depart not from the indicative, notwithstanding the use of the 'if.' But when we say, 'Should it rain' or 'If it rain,' we refer to future time as well as uncertainty, and thus use the subjunctive. The sentence, 'If he comes, he will present the prizes,' given as an example of the subjunctive is ungrammatical, and should be, 'If he come, he will present the prizes.'

We believe it is the fashion to quarrel with the old definition of *the* being a definite article, and terming it instead a distinguishing adjective, in common with *this* and *that*. But the new definition fails in using *the*, as *this* and *that* are used without nouns. We say, 'Give me *this*,' and 'I can see *that*,' but we cannot say, 'I see *the*'; hence and for other reasons we prefer the old definition. We have also yet to learn that *laid* is the plural of *lay*, in the example given (p. 47, part iii.) to show the use of plural verbs to two singular nouns connected by *and*—'The snow lay deep upon the ground,' and 'The wind and the sun laid a wager.' It seems us that Mr. Morrison here confuses singular and plural with past and present. In Part VI., the author tells us that he 'gave a complete list of Saxon prefixes and affixes,' in Part IV. On turning to Part IV. we find these so-called Saxon words under the much more welcome and appropriate heading, English instead of Saxon. We have really had enough of Saxon, Anglo-Saxon, and the rest of it, and infinitely prefer Old English, if need be, to designate the speech of pre-Norman times.

Matriculation Classics. Questions and Answers. By Rev. J. R. Walters, B.A. London: H. K. Lewis.

This opusculum has reached a second edition, and thus we are led to the belief that it must supply a want. Nevertheless, it is of that class of books that are not the most desirable products of this examinational age. The points raised and explained are necessarily in no logical or even grammatical sequence, though an attempt is made to give the semblance of the latter by grouping the questions and answers under such heads as nouns, definitions, principal parts. Despite the ingenuity of the compiler, the impression left is as that of the dictionary-reader. It is very interesting, but the subjects are so disconnected. The good teacher certainly ought neither to allow himself or his pupil to read these books. Their chief use is for the brave, struggling students who are 'teaching themselves.' The answers are correct, though their manner would be a dangerous one for a young scholar to take as a model. They are at once too short and too long. Too short as to length, too long as to individual words. An examinee must never assume that an examiner knows that he knows. Explanations that he would never give to his teacher, inasmuch as the latter is aware that they are within the knowledge of the student, should be given to an examiner. And in the answer to question 4, page 2, we have the words 'syntactical,' 'simultaneous,' 'antecedent' in two lines. Nor is it wise for a matriculation student to enter into details as to the different usages of various writers, or as to doubtful points. Of course, it could not be expected that every question should be answered in detail, but one or two might have been treated thus as models for the student. One-fifth of the book is devoted to Greek questions, and the rest to Latin ones. The best part, on the whole, is the translation of certain English sentences into Latin.

London University Matriculation Papers, with Translations, Answers, and Solutions. June, 1882. By Stephen Barlet. London: Percy Young.

Much that we have written in regard to the book of the Rev. J. Walters might be repeated here. It is a strange result of the fervour for examinations that a publisher can find it worth while to issue a volume of 120 pages containing answers to the papers set at a single examination. We are not sure, again, that the result is a consummation devoutly to be wished. If we grant, however, that it is desirable that young people should be drilled even in the mechanism of question-answering, this volume will serve sufficiently well. The work is well done. In the mathematical and physical papers, a more frequent reference to principles, at the expense of some use of formulæ, might have been preferable. SO^2 is better regarded as the symbol of sulphur dioxide than as that of sulphurous acid. The book is not free from printer's errors, though it is notably free from graver blunders.

A Wall Map of Ireland. With an accompanying Handbook. Edinburgh and London: W. and A. K. Johnston.

We have as much pleasure in expressing our gratification with this map of Ireland as of that of Wales we have already noticed. No pains has been omitted to ensure accuracy, while the boldness of the coast line, the prominence given to the most important names, and the completeness of the information render this fine map all that can be desired. The handbook is really a valuable textbook on the geography of Ireland, and is prefaced by judicious remarks on the plan of teaching. The compiler of this handbook includes the Irish among the large body of Scots who settled in Argyleshire in the beginning of the sixth century. We know not how the Irish will like to be thus disposed of, but we should like to have met with some remarks relative to the heterogeneous sources of the people of Ireland, which may be gleaned from such useful little brochures as Bonwick's, 'Who are the Irish?'

Elementary Botany, Theoretical and Practical. By Henry Edmunds, B.Sc. London: Longmans, Green, and Co.

This small volume is designed to cover the same ground as the elementary examination of the Science and Art Department covers in regards to Botany. The book is systematic and generally accurate. The author has a plan, and our chief regret is that he does not at the outset take his reader into his confidence and state the nature of the plan. We are not sure, further, that to commence with the study of the seed is not rather unphilosophical. If we are to work from the known to the unknown, the best commencement is on the more familiar flower. After an account of the seed and of the cell, a still less known factor in plants, the organs, are studied seriatim, and their structure and functions are dealt with consecutively. This method is clearly preferable to the customary plan of taking anatomy, as a whole, first, and then physiology *en bloc*. A plan for the description of a plant, taken apparently from Aveling's Botanical Tables, a series of questions, and a glossary in which Greek words are printed in English characters for the benefit of those who only know Greek by sight, completes the book, which is exceedingly well illustrated. Unfortunately it is

disfigured by several printer's errors, some of which are in the matter of stops. Examples of these will be found on pages 22, 52, 59, 71, 91, 96, 149. Yet more unfortunately the English is not always of the highest order. An unhappy instance occurs in the very first paragraph of the preface and another in the first line of page 7. 'There appears to be two colouring matters,' on page 8, is not pretty. Our ancient enemy 'different to' crops up more than once, and as to pronouns Mr. Edmunds is almost as vague as Clarendon. Pages 9, 24, 39, furnish evidence on this point. But the writer's chief foe is 'and which,' whilst 'which,' single-handed at times, overcomes him. He is, moreover, a slave to the subjunctive, and as result of his servitude gives us such a sentence as, 'If a vessel be closed below by a piece of bladder whilst a tube be tightly fastened in the neck.' We commend to Mr. Edmunds a sentence from Professor Adams' excellent work on the English language: 'The present tendency of the English language is to reject the distinction of the subjunctive mood.' We lay stress upon these inelegancies and inaccuracies in a book on botany because we are firmly convinced as to the necessity of physical science being taught in accurate, well-chosen English. The young student ought to be brought into contact with every phase of culture, and if he finds looseness of grammatical expression, he will begin to suspect a possible looseness of botanical thought.

Several blunders in the volume under consideration seem to point to the conclusion that the writer is not strong in his chemistry. Thus, the formula of cellulose is given wrongly on page 6, and three pages further on the mistake is corroborated by the statement that 'starch has the same chemical composition as cellulose.' Now the formula of starch is $C^6H^{10}O^5$ and that of cellulose is $(C^6H^{10}O^5)^3$. We may be told that to point out such distinctions as this in an elementary book is unwise. We answer that the best method is to teach the whole truth rather than a part of it. In the particular case in point, the student of botany may never study organic chemistry and may never find out the slight error. But whether he does find it out or not, we are convinced that the best plan is to teach the whole truth if possible, and not only a part of it. The teacher in saving himself the trouble of a little more explanation may give the pupil far more trouble in his after studies. A similar criticism applies to the phrase 'salts of lime,' that is substituted for the more exact 'salts of calcium,' and to 'copper solution' in place of copper sulphate.

Something of looseness of phraseology pervades also the the strictly botanical part of the work. In the preface the word description takes the place of anatomy. Nor is it wise to speak of the two kingdoms of organised beings merging the one into the other, unless the young student is shown where that merging takes place. The confusion as to the meanings of the words anatomy, morphology, and histology, that we had occasion to notice in Dr. Vine's Translation of Prantl, obtains here, and is indeed rendered worse confounded by the statement that anatomy treats of *internal* structure. The misleading word, 'albumen,' is still retained, and that the coniferæ have many cotyledons is stated twice. Measurements are given in inches rather than in millimetres, two root functions on page 34 grow to four on pages 38, 39. Carbon dioxide is said to be taken in at the *pores* of the leaf, the pappus of Compositæ is a calycine development, the older names adnate and innate for anthers are preferred to the far more intelligible ones dorsifixed and basifixed. Finally, the use of the word 'intended' as to structures encountered in our study of physical science is questionable. We are justified in stating what functions particular parts subserve, but scarcely in saying aught as to purpose or intention in respect to them.

The book is, despite these and other shortcomings, a good book. It is well abreast of modern scientific knowledge, and its author has read the Germans. He shows himself a practical teacher by such suggestions as the one as to the method of teaching the kinds of vernation given on page 67. His account of the two effects of plants on the air, the one a respiratory, the other a digestive effect, is very clear. The plan adopted in dealing with this subject and the general build of the whole book, have led us to speculate whether its author was ever a student at the botany class at the Birkbeck Institution.

Grammar of Elocution. By John Millard. London: Longmans.

The real secret of good speaking is deep feeling: no man can stir a crowd with his tongue who does not bring up his utterances from the well-spring of his heart. Artificial rules will avail very little even to the help of natural eloquence, and as to its creation are practically nothing worth: as the author truly says, 'None can be made rivals to Demosthenes, Cicero, or Garrick in twelve lessons'—no, nor in twelve thousand: as with the poet, so with the orator, 'ille nascitur, non fit. And in particular as to the 'removal of stammering,' an affliction mainly due to nervous irritability, perhaps consequent on ill-health; didactic information and lessons in utterance are feeble curatives compared with courage and faith and prayer, as some stammerers who have cured themselves know experimentally. The best and most attractive part of Professor Millard's book is the voluminous appendix of passages for elocutionary practice selected from our chief writers in prose and poetry.

Art Instruction in England. By F. E. Hulme, F.L.S. London: Longmans.

The author is justly enough caustic and critical against the false old system of ordinary drawing masters, who themselves did the most part of their pupils' exercises, and so cheated parents into admiration of their children's works, due mainly to the paints and pencil of the teacher. Freehand drawing is the best and most honest exercise for eye and head; and there can be no fraud here: let the pupil copy for himself what he sees, and whether he succeeds or fails in imitation, by all means let there be no touching up. 'Drawing,' to quote the excellent common-sense remarks of Redgrave, 'is a language, an intelligent mode of communicating thoughts, "known and read of all men."'

The whole extract is too long for our space; but the booklet is so small and so full of excellent matter, that it deserves to be bought and read in its entirety.

Old Stories from British History. By F. York Powell, M.A. London: Longmans and Co.

These 'Old Stories,' penned as they are by a master-hand, will charm both old and young. We are sorry, however, that we cannot recommend the book for use in the standard for which it has been prepared, namely, the first. It is far too difficult. The second sentence on the first page reads:—

'For some time after they came here they were heathens, like some of the black people you read about who live in foreign lands beyond the sea, and like them they worshipped many gods, and believed many strange stories about them.' And on the very next page the first sentence is:—

'There were good sailors and brave soldiers, hard-working farmers, and skilful smiths, and carpenters among them; and they could take care of themselves, and hold their own whether at work or play.'

These extracts, taken at random, fairly indicate the character of the book, which is certainly stiff enough for the third standard, never to mention the first. Indeed, if the paragraphs were shorter and a few more stories added, the book would make an excellent standard three historical reader adapted in all respects to the Mundella Code. The little book is printed in beautiful type, and is well and suitably illustrated.

Reep's Summary of English History. London: Longmans and Co.

This is an admirable 'Summary,' based on Mr. Gardiner's 'Outlines of English History,' and cannot fail to prove valuable to any candidate reading up for an examination.

Talks about Science. By the late Thomas Dunman; with a Biographical Sketch, by Charles Welsh. London: Griffith and Farran.

We had the pleasure of bearing our testimony of commendation to the 'Glossary of Biological, Anatomical, and Physiological Terms,' by the same author, whose death, we regret to learn, took place a month or two ago. The short biographical sketch furnished by Mr. Welsh is deeply interesting, and shows the influence of modern scientific teaching in awakening the intelligence and stimulating the efforts of the youth around us. Mr. Dunman had barely attained the age of thirty-two years at his death, and had marked his too brief life by great zeal and usefulness as a scientific lecturer and teacher, in addition to his engagement as professor of physiology at the Birkbeck Institution and lecturer at the Working Men's College in Great Ormond Street. The volume before us contains thirteen lectures on scientific subjects, and though of varied merit are all marked by accuracy and clearness. They are enlivened by occasional touches of humour, which we suppose is a necessary feature of the popular lecture. For a general introduction to the subjects on which they treat, they will well repay the attention of the student and general reader. They are marked by the carefulness of demonstration and absence of mere theorizing upon insufficient data that marked the old popular lecturers, and are also distinguished from the latter by a steadfast tone of instruction and the absence of the mere element of amusement which has played such havoc with the scientific designs of Dr. Birkbeck and the friends of the old Mechanics' Institutions. The example of Thomas Dunman shows that the scientific lessons of Huxley and his disciples are bearing good fruit. The increased attention now given to physiology—geology especially—and the careful manner in which these subjects are studied is very gratifying. Teachers may be greatly encouraged in the work of commencing an elementary acquaintance with science among their pupils by the certainty of their labours being successful in stimulating many to a life of thoughtful observation and inquiry. Let us take courage! The schoolmaster is abroad! and the seed he now sows falls neither among thorns nor in stony places.

Our Little Ones. London: Griffith and Farran.

The excellence of this magazine is maintained in the most recent numbers. As usual, the illustrations are superb.

Italy's Liberator: The Story of General Garibaldi's life. London: Partridge and Co.

'A pure, spotless, patriot-hero,'—such is the character of Giuseppe Garibaldi, as his life has shown and history records; this well-written little memoir amply proving his courageous and unselfish excellence. He was the son of an honest sailor, though a zealous Papist; which latter phase of mind reacted on Garibaldi in a thorough hatred of priestcraft; whilst his mother's fervent piety appears to have mainly influenced his strong feelings of natural—as opposed to ecclesiastical—religion. The incidents of Garibaldi's career are well known, and are detailed in this neat little volume simply and clearly; whilst its profusion of illustrations, both within and without, will serve as an additional recommendation to thousands of readers.

Latin Course (First Year), comprising Grammar to the End of the Regular Verbs and Exercises with Vocabularies. London: W. and R. Chambers.

An anonymous but worthy little book. Very much new matter or even new arrangement is hardly to be expected in a book of this sort, and perhaps the most striking novelty in it is the title-page. This is absolutely destitute of any punctuation marks whatever. The selection of grammatical fragments is, on the whole, well made, and the exercises, very wisely relegated to the end of the volume, far away from the ease-giving vocabulary and the attractive paradigm, are of sufficiently typical sentences, although twenty-one of them hardly seems a sufficient number for even a first-year student of Latin. A child might manage one a week, at least. We are inclined to think that definitions of such words as gender and number might be given with advantage. Such definitions are of value in a book like this for repetition and for reference sake. After each declension follows a careful selection of the chief difficulties in regard to the nouns of that declension, and on page 22 the pupil is wisely taught to decline adjective and noun simultaneously. The summing up on page 11 as to nouns in *es*, the amended and extended list of nouns whose significance varies in the singular and plural numbers, and the clearing up of the perennial difficulty of the youthful student as to the future subjunctive and future infinitive of deponent verbs, effected on page 60, are all points of merit. The book may be recommended to all who have not the ingenuity and the patience to effect for themselves the work done by this little volume.

Chambers's Historical Readers, Nos. 1 and 2. London: W. and R. Chambers.

The two volumes have evidently been prepared by a practised hand. They contain much sound information presented in a form that children can readily understand. Overworked teachers will thank us for drawing their attention to a valuable negative merit which they possess—a merit which ought to be fully appreciated in these days—viz., that of *not being too long*. These capital readers contain ample matter for the standards for which they are designed.

Blackie's Geographical Reader, No. 1 for Standard I.; **Blackie's Geographical Reader,** No. 2 for Standard II. London: Blackie and Son.

These two little books, which have been prepared to meet the now well-known requirements of Mr. Mundella's Code, are worthy of the highest praise. Practical, handy, printed in Messrs. Blackie's best style on good paper, enriched with excellent and appropriate illustrations, strongly bound, and last but not least, well within the grasp of the children for whom they are designed, these introductory Geographical Readers are sure to be largely used in our public elementary schools.

Pictures of English History for Standard V. London: Nelson and Sons.

It would be a hard task to please either inspector, teacher, or scholar who would not be satisfied, nay, even gratified, with these pleasant pictures. Each picture, written in an attractive style, is prefaced with a short but valuable summary of the reign from which it is taken. The book is admirably adapted for a reader, notes and vocabularies having wisely been retained at the end of each lesson. The illustrations and general get up of the volume are worthy of the famous house whose imprint it bears.

Query Column.

☞ **As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'**

RULES.

1. Each correspondent is restricted to *one question*. We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'*The Query Editor*,'
The Practical Teacher,
Pilgrim Street, Ludgate Hill,
London, E.C.

Arithmetic.

1. W. B. W., Grimsby.—A merchant mixes wine at 16s. with equal quantities at 17s. and 20s. per gallon, so that it might be sold at 18s. What proportion at each price was mixed?

Loss on wine at 16s. = 2s. per gal.
,, ,, 17s. = 1s. ,,
Gain ,, 20s. = 2s. ,,

∴ Gain on equal quantities at 17s. and 20s. = 1s. per gal.
∴ Wine at 16s. : equal quantities of wine at 17s. and 20s.
:: 1 : 2.

That is, the wines must be mixed in the proportion of 1 gallon at 16s. to 2 gallons at 17s., and 2 gallons at 20s.

2. TARDUS, Newport.—If 56 horses eat 30 bushels of oats in 15 days, how many oxen will eat 50 bushels in 20 days, if the rates of eating of an ox and a horse are as 3 to 5?

$$\left.\begin{array}{ccc} \text{bus.} & & \text{bus.} \\ 30 & : & 50 \\ \text{days} & & \text{days} \\ 20 & : & 15 \end{array}\right\} \text{horses} :: 56$$

$$= \frac{\overset{5}{\cancel{50}} \times \overset{3}{\cancel{15}} \times \overset{14}{\cancel{56}}}{\underset{2}{\cancel{30}} \times \underset{4}{\cancel{20}}} \text{ horses}$$

$$= 70 \text{ horses.}$$

5 horses eat as much as 3 oxen,
∴ 70 ,, ,, (3 × 14) oxen
= 42 oxen. Ans.

3. YELSERP.—What sum would be saved annually if the interest on a public debt of £4,000,000 were reduced from 3½ per cent. to 3 per cent.? If, in consequence, the price of this stock fell from £101 to £95⅞, how much would the whole property of the fundholders be diminished? (*Barnard Smith.*)

Sum saved = ½ p. c. on £4,000,000
= ½ of £40,000
= £20,000. Ans.

Amount diminished = (101 − 95⅞) p. c. on £4,000,000
= 5⅛ of £40,000
= £200,000 + £25,000
= £225,000. Ans.

NOTE.—Writing pretty good.

4. DON TALVA, Arbroath.—Divide £1766 7s. 10d. among A, B, and C, so that 5 times A's share, 6 times B's, and 7 times C's may be equal.

$$\tfrac{1}{5} + \tfrac{1}{6} + \tfrac{1}{7} = \frac{42 + 35 + 30}{210} = \frac{107}{210};$$

£1,766 7s. 10d. ÷ 107 = £16 10s. 2d.
∴ A's share = £16 10s. 2d. × 42 = £693 7s.
B's ,, = ,, × 35 = £577 15s. 10d.
C's ,, = ,, × 30 = £495 5s. } Ans.

5. TIMBER.—At what time between 11 and 12 o'clock are the hour and minute hands of a watch—1st together, 2nd at right angles, and 3rd directly opposite?

The minute hand moves twelve times as fast as the hour hand;
∴ The difference between the rates of the minute and hour hands is eleven times the rate of the hour hand.

1st. The minute hand must gain 55 minutes on the hour hand to be together;
∴ Distance gone by hour hand = 55 min. ÷ 11 = 5 min.
∴ Time when the hands are together = 12 o'clock.

2nd. The minute hand must gain 10 and 40 minutes respectively on the hour hand to be at right angles;
∴ Distance gone by hour hand = 10 min. ÷ 11 and 40 min. ÷ 11 = $1\frac{10}{11}$ min. and $3\frac{7}{11}$ min.
∴ Time when the hands are at right angles = $10\frac{10}{11}$ min. and $43\frac{7}{11}$ min. past 11 o'clock.

3rd. The minute hand must gain 25 minutes on the hour hand to be directly opposite;
∴ Distance gone by hour hand = 25 min. ÷ 11 = $2\frac{3}{11}$ min.
∴ Time when the hands are directly opposite = $27\frac{3}{11}$ min. past 11 o'clock.

6. LANCASTER.—If 9 oxen are kept for the same money as 7 horses (for any given time), and a team of oxen are ½ as long again in ploughing 97 acres, as the same number of horses in ploughing 90 acres, and a field costs as much whether ploughed by oxen or horses, *viz.*, £7 5s. 6d.; the same men being required in both cases and being paid by the time, what is due to them? (*Colenso.*)

Cost of food for 9 cows = cost of food for 7 horses,
∴ Quantity of food eaten by cows = $\frac{7}{9}$ of quantity of food eaten by same number of horses.
Number of acres ploughed by horses while same number of cows plough 97 acres = 90 × $\frac{8}{7}$ = 108.
∴ With cows the men are paid $\frac{108}{97}$ times as much as with horses;
∴ Excess of money for labour with cows = $\frac{108}{97} - 1 = \frac{11}{97}$ of the cost of labour with horses.
Cost of food for cows = $\frac{7}{9}$ of $\frac{12 \cdot 97}{97} = \frac{84}{97}$ of cost of food for horses;

$\therefore$ Excess of cost of food for horses $= 1 - \frac{11}{13} = \frac{2}{13}$ of cost of food for horses.

$\therefore \frac{11}{13}$ of the cost for labour with horses $= \frac{11}{13}$ of cost of food for horses.

11 times cost of labour with horses = 13 times cost of food for horses;

$\therefore$ Cost of labour with horses $= \frac{13}{11+13}$ of £7 5s. 6d.

$= \frac{13}{24}$ of £7 5s. 6d.

$= £3$ 18s. $9\frac{3}{4}$d.

Cost of labour with cows $= \frac{13+13}{13}$ of cost of labour with horses.

$= \frac{26}{13}$ of £3 18s. $9\frac{3}{4}$d.

$= £4$ 7s. 9.

Mensuration.

1. A STREET ARAB.—Two similar logs of wood, each measuring 18 ft. in length and $8\frac{1}{2}$ inches sq. sectional area, were sent to be sawn up, each into 11 boards of equal thickness, to floor a room. A saw which destroyed $\frac{1}{8}$ inch of the board in making its cut was used, and in consequence there was inefficient flooring material. Had similar boards been cut with a saw which destroyed $\frac{1}{11}$ as much, there would have been a surplus of $22\frac{1}{2}$ sq. ft. What was the area of the room?

Breadth of boards in second case $= (8\frac{1}{2} - \frac{1}{11}$ of $\frac{1}{8})$ in.

$= (8\frac{1}{2} - \frac{1}{88})$ in.

$= 8\frac{43}{88}$ in.

Area of each board $= 8\frac{43}{88}$ in. $\times$ 18 ft.

,, boards $= \left(\frac{743}{88} \times \frac{\overset{3}{\cancel{18}}}{\underset{1}{\cancel{11}}} \times \frac{\overset{2}{\cancel{11}}}{1}\right)$ sq. ft.

$= \frac{2232}{4}$ sq. ft.

$= 278\frac{1}{2}$ sq. ft.

$\therefore$ Area of floor $= (278\frac{1}{2} - 22\frac{1}{2})$ sq. ft.

$= \underline{256\frac{1}{2} \text{ sq. ft.}}$

Note.—*Reid's* 'Dictionary of the English Language,' 6s. 6d. (Oliver and Boyd); *Webster's* 'Dictionary of the English Language,' 10s. 6d. (George Routledge and Sons).

General.

1. IGNORAMUS.—We think your best plan would be to write to the Religious Tract Society (Paternoster Row) or the Society for Promoting Christian Knowledge (Northumberland Avenue, Charing Cross), for lists of their publications.

2. IGNORANCE.—Writing fair, but apparently needs practice. Make a point of never writing anything in a slipshod careless way, and you will soon find a marked improvement.

3. PRECEPTOR.—We cannot name a cheap treatise on the subject you mention, except in the shape of magazine articles, one of which appeared in 'All the Year Round,' under the heading, *A Question of Ancestry*, another in 'St. Paul's Magazine,' entitled *Briton or Saxon*. In the way of a complete treatise we should recommend *Dr. Nicholas's* 'Pedigree of the English,' a thick 8vo. volume, to be had for 5s. or 6s.

4. H. R. L.—Text:—The *Rugby* edition is good (Rivingtons), and you might try *Hunter's* (Longmans), or the *Globe* (Macmillan), or the *Leopold* (Cassell's). Works on the plays:—*Lloyd's* 'Critical Essays' (Bell and Sons, 2s. 6d.); *Hazlitt's* 'Characters of Shakspere's Plays' (Bell and Sons, 2s.), and *Gervinus's* 'Commentaries' (Kegan Paul, Trench and Co., 14s.), would be useful. So far as we know there is no *special* work on the particular play you mention.

5. CYMRO GLAN.—'How to draw a Map' (Hughes, 1s.), will give you the desired information.

6. MATHEMATICUS.—You cannot well do better than expend 2s. on 'What to Read, and How to Read it,' a small handbook to the Matriculation Examination, published by Stewart and Co., Holborn Viaduct Steps.

7. ENTRE NOUS.—The letter *H* is silent on the following words: *heir*, and its derivatives *hairless*, *heirloom*, etc.; *herb* (sometimes); honour, and its derivatives *honorarium*, *honorary*, etc.; *honest*, *hospital* (sometimes); *hotel* (sometimes); *hostler* (sometimes); *hour*, *humble* (sometimes); humour, and its derivatives. There is no rule. Writing good, and will improve with practice.

8. AGRICOLA.—The following will probably be useful:—*Carey's* 'Principles of Agriculture,' 2s. (Thomas Murby); 'Handbook of Agriculture,' by *S. Tomlinson*, 6d. (Thomas Brear, Bradford, Yorkshire).

9. ASHCROFT.—You will find the solution of your query in the January No.

10. DERMOT.—Your query was solved in the January No.

11. D. T. Z.—The solution of your query appeared in our issue for February.

12. NORTHUMBERLAND. — *Magnus's* 'Mechanics' (Longmans, 3s. 6d.); *Irving's* 'Heat' (Longmans, 2s. 6d.); *Magnus's* 'Hydrostatics' (Macmillan, 1s. 6d.); *Haughton's* 'Optics' (Cassell); Deschanel, I., II., IV., each 4s. 6d. (Blackie).

13. JUNIOR.—Your analysis is correct, with the exception of placing '*if*' in the predicate in the first sentence.

14. C. E. R., Wigan.—There is no legal remedy for you. You had better represent the case to the Head Master in a proper spirit, who ought to see fully to your interests.

Algebra.

1. J. BARAGWANATH.—Find the G. C. M. of $x^3 + ax^2 - axy - y^3$ and $x^4 + 2x^3y + x^2(y^2 - a^2) - 2axy^3 - y^4\left(x + 2y - a\right)$ $x^4 + ax^3 - axy - y^3$ (*Tollhunter.*)

$$
\begin{array}{r|l}
x^4 + ax^3 - axy - y^3 & x^3 + x(y+a) + y^2 \\
\hline
x^4 + 2x^3y + x^2(y^2 - a^2) - 2axy^3 - y^4 & x + (y+a) + y^2 \\
x^4 + ax^3 - axy - y^3 & \\
\hline
x^3y + x^2(y^2 + ay - a^2) + x(y^3 - 2ay^2) - y^4 & \\
x^3y + ax^2(y+a) + xy^3 & \\
\hline
(2y-a)x^2 + x(y^3 - a^2) - y^4 & \\
(2y-a)x^2 + x(2ay - a^2) + y^3 & \\
\hline
x(-2ay^2 + a^2y) - y^4 - ay^3 & \\
x(y^3 - ay) + x(y^3 - a^2y) + y^4 - ay^3 & \\
\hline
x^3 + x(y+a) + y^2 & \\
x^3 + x(y+a) + y^2 & \\
\hline
-ax(y+a) - ay^3 & \\
-ax(y+a) - ay^3 & \\
\hline
0 & 0
\end{array}
$$

Dividing by $y^2 - ay$

$x^2 + x(y+a) + y^2$

$\therefore$ G.C.M. $= \underline{x^2 + (a+y)x + y^2}$

2. CONO.—Simplify:—

(*a*) $2\sqrt[3]{54} + 3\sqrt[3]{32} - 7\sqrt[3]{128} - 5\sqrt[3]{2} + 9\sqrt[3]{250}$.

(*b*) $\dfrac{7\sqrt{2} + 3\sqrt{14}}{29 - 2\sqrt{7}}$

(*a*) $2\sqrt[3]{54} + 3\sqrt[3]{32} - 7\sqrt[3]{128} - 5\sqrt[3]{2} + 9\sqrt[3]{250}$

$= 2\sqrt[3]{27 \times 2} + 3\sqrt[3]{8 \times 4} - 7\sqrt{64 \times 2} - 5\sqrt[3]{2} + 9\sqrt[3]{64 \times 4}$

$= 2 \times 3\sqrt[3]{2} + 3 \times 2\sqrt[3]{4} - 7 \times 4\sqrt[3]{2} - 5\sqrt[3]{2} + 9 \times 4\sqrt[3]{4}$

$= 6\sqrt[3]{2} + 6\sqrt[3]{4} - 28\sqrt[3]{2} - 5\sqrt[3]{2} + 36\sqrt[3]{4}$

$= 4^2\sqrt[3]{4} - 27\sqrt[3]{2}$

$= \underline{3\sqrt[3]{2}(14\sqrt[3]{2} - 9)}$. Ans.

(*b*) $\dfrac{7\sqrt{2} + 3\sqrt{14}}{29 - 2\sqrt{7}}$

$= \dfrac{(7\sqrt{2} + 3\sqrt{14})(29 + 2\sqrt{7})}{(29 - 2\sqrt{7})(29 + 2\sqrt{7})}$

$= \dfrac{245\sqrt{2} + 101\sqrt{14}}{841 - 28}$

$= \underline{\dfrac{\sqrt{2}(245 + 101\sqrt{7})}{813}}$. Ans.

3. YRREB.—A train left Cambridge for London with a certain number of passengers, 40 more second-class than first-class; and 7 of the former would pay together 2s. less than 4 of the latter. The fare of the whole was £55; but they took up, half-way, 35 more second-class and 5 first-class passengers, and the whole fare now received was ½ as much again as before. What was the first-class fare, and the whole number of passengers at first?—*Colenso.*

Let x = fare of first-class in shillings,

Then $\frac{4x-2}{7}$ = „ „ second-class „ ;

$$\therefore \tfrac{1}{2}(x \times 5 + \frac{4x-2}{7} \times 35) = \tfrac{1}{2} \text{ of } 1100$$
$$= 220$$
$$5x + 5(4x-2) = 440$$
$$x + 4x - 2 = 88$$
$$5x = 90$$
$$\therefore x = 18.$$

∴ first-class fare = 18s.

second-class „ $= \frac{72-2}{7}$s. = 10s.

Again, let x = No. of first-class passengers at first,

Then $x+40$ = „ „ second-class „ „ „ ;

$$\therefore x \times 18 + (x+40) \times 10 = 1100$$
$$18x + 10x + 400 = 1100$$
$$28x = 700$$
$$\therefore x = 25.$$

∴ No. of passengers at first = 25 + 25 + 40 = 90.

4. ANXIOUS.—Find the coefficient of x^5 in the expansion of $(1 + 2x + 3x^2)^7$.

In this case,

$$q + 2r = 5, p + q + r = 7.$$

The solutions are $r = 2, q = 1, p = 4$; $r = 1, q = 3, p = 3$; $r = 0, q = 5, p = 2$.

$$\therefore \text{Coefficient} = \frac{\lfloor 7}{\lfloor 2 \rfloor 4} 2^1 . 3^2 + \frac{\lfloor 7}{\lfloor 3 \rfloor 3} 2^3 . 3^1 + \frac{\lfloor 7}{\lfloor 5 \rfloor 2} 2^5$$
$$= 105 \times 2 \times 9 + 140 \times 8 \times 3 + 21 \times 32$$
$$= 1890 + 3360 + 672$$
$$= 5922.$$

5. MOI.—Simplify:—

$$\frac{\left\{(a^m)^{\frac{1}{r}}(a^q)^{\frac{1}{s}}\right\}^{sr}}{\left\{\sqrt[q]{b^m}\left(\sqrt[m]{b}\right)^r\right\}^{mq}} \div \left\{\left(\frac{a}{b}\right)^q\right\}^r. \quad \textit{(Todhunter).}$$

$$\frac{\left\{(a^m)^{\frac{1}{r}}(a^q)^{\frac{1}{s}}\right\}^{sr}}{\left\{\sqrt[q]{b^m}\left(\sqrt[m]{b}\right)^r\right\}^{mq}} \div \left\{\left(\frac{a}{b}\right)^q\right\}^r$$
$$= \frac{\left\{a^{\frac{m}{r}} \times a^{\frac{q}{s}}\right\}^{sr}}{\left\{b^{\frac{m}{q}} \times b^{\frac{r}{m}}\right\}} \div \left(\frac{a}{b}\right)^{qr}$$
$$= \frac{a^{ms} \times a^{qr}}{b^{ms} \times b^{qr}} \div \frac{a^{qr}}{b^{qr}}$$
$$= \frac{a^{ms}}{b^{ms}}$$
$$= \left(\frac{a}{b}\right)^{ms}. \quad \text{Ans.}$$

6. DISCIPULUS.—On the ground are placed n stones; the distance between the first and second is one yard, between the second and third three yards, between the third and fourth five yards, and so on. How far will a person have to travel who shall bring them, one by one, to a basket placed at the first stone?

There are $(n-1)$ journeys; the first is of 2 yards, the second of 2 (1+3) yards, the third of 2 (1+3+5) yards and so on.

Thus the first journey is of 2×1 yards, the second of 2×4 yards, the third 2×9 yards, and so on. We have, therefore, to find the sum of 1, 4, 9, etc., that is, $1^2, 2^2, 3^2$, etc., to $(n-1)$ terms.

The sum of the squares of the first n natural numbers

$$= \frac{n(n+1)(2n+1)}{6};$$

$$\therefore \text{Sum to } (n-1) \text{ terms} = \frac{(n-1)\,n\,(2n-1)}{6};$$

$$\therefore \text{Distance} = \left\{\frac{n(n-1)(2n-1)}{6} \times 2\right\} \text{ yards},$$
$$= \tfrac{1}{3}\,n\,(n-1)\,(2n-1) \text{ yards.} \quad \text{Ans.}$$

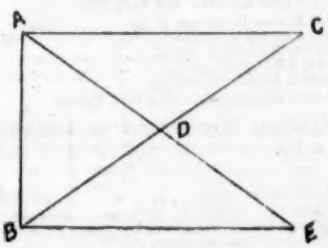
7. J. P. BAILESTONE.—

Solve:—$\left(\frac{x}{x-1}\right)^2 + \left(\frac{x}{x+1}\right)^2 = n(n-1)$.

$$\left(\frac{x}{x-1}\right)^2 + \left(\frac{x}{x+1}\right)^2 = n(n-1)$$
$$x^2(x+1)^2 + x^2(x-1)^2 = n(n-1)(x^2-1)^2$$
$$x^4 + 2x^3 + x^2 + x^4 - 2x^3 + x^2 = n(n-1)(x^4 - 2x^2 + 1)$$
$$x^4\{n(n-1) - 2\} - 2x^2\{n(n-1) + 1\} + n(n-1) = 0$$
$$x^4 - 2x^2\frac{n(n-1)+1}{n(n-1)-2} + \left\{\frac{n(n-1)+1}{n(n-1)-2}\right\}^2$$
$$= -\frac{n(n-1)}{n(n-1)-2} + \left\{\frac{n(n-1)+1}{n(n-1)-2}\right\}^2$$
$$= \frac{4n^2 - 4n + 1}{\{n(n-1)-2\}^2}$$
$$x^2 - \frac{n(n-1)+1}{n(n-1)-2} = \pm\frac{2n-1}{n(n-1)-2}$$
$$x^2 = \frac{n^2+n}{n^2-n-2} \text{ or } \frac{n^2-3n+2}{n^2-n-2}$$
$$= \frac{n}{n-2} \text{ or } \frac{n-1}{n+1}$$
$$\therefore x = \pm\sqrt{\frac{n}{n-2}} \text{ or } \pm\sqrt{\frac{n-1}{n+1}}. \quad \text{Ans.}$$

Geometry.

1. MATHEMATICIAN.—In a right-angled triangle, show that the distance of the middle point of the hypotenuse from the right angle is equal to half the hypotenuse.



Let ABC be a right-angled triangle, having the angle at A a right angle, and let AD be drawn to the point of bisection of BC.

Then AD shall be equal to half BC.

Produce AD to E, making DE equal to AD, and join BE.

Proof.—In the triangles ADC, BDE, the two sides AD, DC = the two sides ED, DB, each to each,

and the angle ADC = the angle EDB; (I. 15.)

∴ the base AC = the base EB, (I. 4.)

and the angle CAD = the angle BED.

Because AE meets the two straight lines AC, BE, and makes the alternate angles CAE, AEB equal to one another,

∴ AC is parallel to BE. (I. 27.)

Because AC is parallel to BE, and AB meets them, the two interior angles CAB, ABE are together equal to two right angles; (I. 29.)

but the angle CAB is a right angle; (Hyp.)

∴ the angle ABE is a right angle.

Hence in the triangles BAC, ABE,

the two sides BA, AC = the two sides AB, BE, each to each,

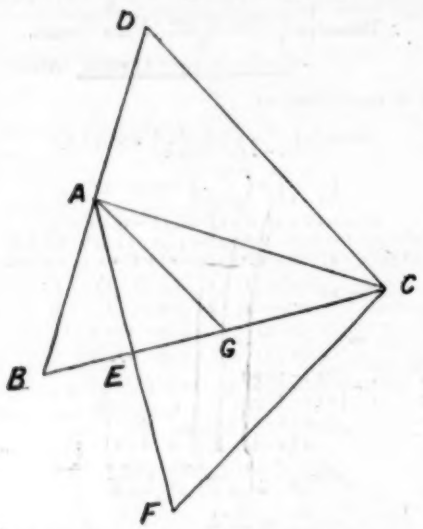
and the angle BAC = the angle ABE; (Ax. 11.)

∴ the base BC = the base AE;

and AD is half of AE; (Con.)

wherefore AD is equal to half BC. Q.E.D.

2. VIFIONFAB.—If one angle of a triangle be a right angle, and another equal to two-thirds of a right angle, prove from the First Book of Euclid, that the equilateral triangle described on the hypotenuse is equal to the sum of the equilateral triangles described upon the sides which contain the right angle.



Let ABC be a triangle, having the angle at A a right angle, and the angle at B equal to two-thirds of a right angle.

Then the equilateral triangle described upon BC shall be equal to the equilateral triangles described upon AB, AC.

Produce BA to D, making AD=BA; join DC.

Then BDC is an equilateral triangle described upon the hypoenuse BC. (I. 4 and I. 6.)

Draw AE perpendicular to BC, and produce it to F, making EF=AE, and join FC.

Then AFC is an equilateral triangle, (I. 4, I. 32, and I. 6), and it is described on AC.

Lastly, cut off from EC, a part EG=EB, and join AG; then ABG is an equilateral triangle described upon AB.

Proof.—Triangle AFC=twice triangle AEC,
and " ABG= " " ABE;
∴ Triangles AFC, ABG=twice triangles AEC, ABE,
=twice triangle ABC:
but triangle BDC=twice triangle ABC;
∴ Triangle BDC=triangles AFC, ABG. Q.E.D.

[We regret to state that the answers to several queries must be held over till our next issue.]

ANNUAL DRILL COMPETITION OF BOARD SCHOOL BOYS.—The annual drill competition of boys from Board Schools for the challenge banner given by the Society of Arts took place on Saturday, July 29th, by the permission of the Archbishop of Canterbury, in the grounds of Lambeth Palace, in the presence of Mr. E. N. Buxton, the chairman, and several other members of the Board. Only eleven schools out of the whole number competed. The boys were put through various evolutions by Mr. Sheffield, the drill-master, including a march past in open column, formation in fours right and left, wheeling in companies, marching in line and counter-marching, and finally were drawn up in square, when Mr. Buxton said they had all done well, and he had had great difficulty in deciding which had done best, but he must award the banner to the Portman Place (Mile End) School, which held it last year, and he thought the Medburn Street (St. Pancras) School came next. The boys thereupon gave three cheers for Mr. Buxton and three more for the Board, and then marched out of the grounds.

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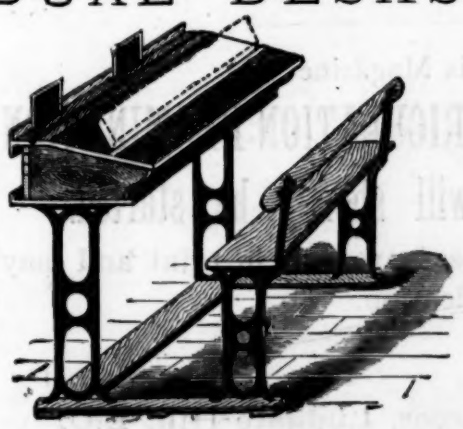

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